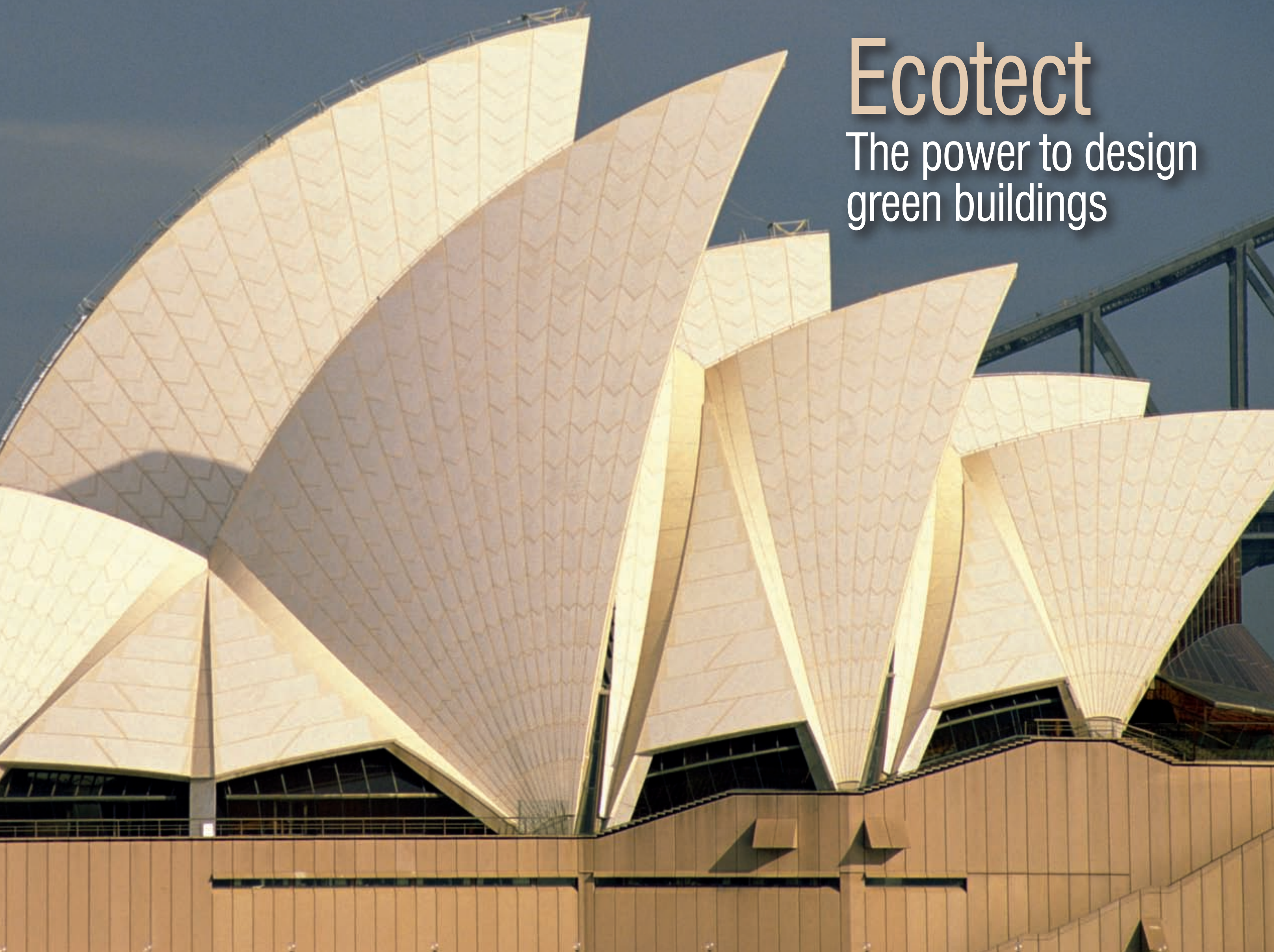
January/February 2008 >> Vol.35

# AEC MAGAZINE

DESIGN, MANAGEMENT & COLLABORATION IN THE BUILT ENVIRONMENT



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BIM lays foundations for Sydney Opera House maintenance

## Ecotect

The power to design green buildings

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**Managing Editor:** Greg Corke
Email: greg@edaltd.co.uk
**MCAD Technical Editor:** Alistair Lloyd Dean
Email: al@edaltd.co.uk
**Consulting Editors**
Martyn Day
Email: martynday@mac.com
John Marchant
Email: john.marchant@skilstream.com
**Publisher:** Geoff Walker
Email: geoff@edaltd.co.uk

**Design and Production**
Dave Oswald
Email: dave@edaltd.co.uk

**Advertising**
**Group Advertising Manager:** Peter Jones
Email: peter@edaltd.co.uk
**Deputy Advertising Manager:** Steve Banks
Email: steve@edaltd.co.uk
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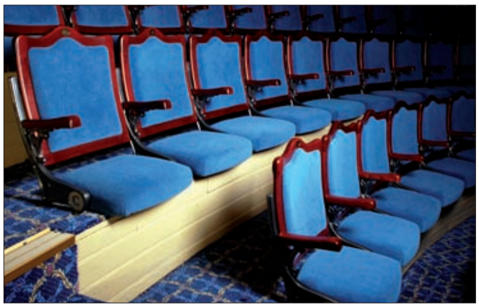


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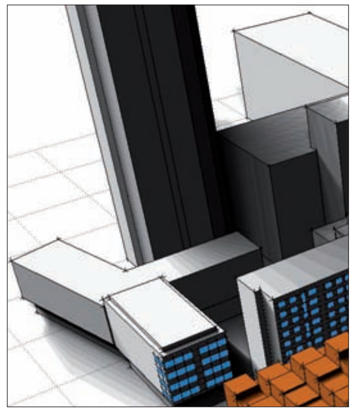








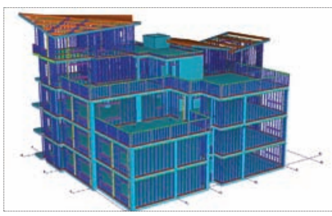
















# Bentley strengthens portfolio with three New Year acquisitions



**January** was a busy month for Bentley with three acquisitions in the areas of bridge design, building services engineering, and electrical control system design.

First up, Bentley acquired Leap Software, a specialist provider of software for the analysis and design of concrete bridges. The company has a strong footing in the US and its bridge solutions are used by 37 US state departments of transportation, the US Federal Highway Administration, a large number of city and county agencies, and top bridge engineering consultants. The flagship product, Leap Bridge, is an analysis, design, and load-rating application that integrates all bridge design components into one application with a single user interface. According to Bentley, the Leap products will complement and strengthen its end-to-end bridge design and management solution, which includes Bentley Bridge RM for cable-stayed, suspension, and segmental bridges; Bentley BridgeModeler and Bentley LARS for bridge load-rating calculation, analysis, and analytical modeling; Geopak Bridge; InRoads Bridge; Bentley Rebar; Bentley PowerRebar; and many other products. This latest move by Bentley follows its acquisition of TDV in May last year. This Austrian bridge software specialist's RM 2006 product is used for static and dynamic design and analysis of steel, concrete, and composite structures.

On the building services engineering front, Bentley has acquired Hevacomp, the Sheffield-based software provider. Included in its portfolio is software for energy analysis, heating and cooling load calculations, pipe and duct sizing, and electrical system design and product catalogues. Hevacomp's software is also certified to perform $CO^2$ emissions calculations required under Part L of the UK building regulations.

Commenting on this latest Bentley acquisition, CEO Greg Bentley said, "The Hevacomp product line is an important addition to our growing portfolio of solutions that help sustain infrastructure and the environment. Hevacomp's substantive analysis applications leverage the content of the Building Information Model, incorporating rigorous engineering and enabling infrastructure professionals and owner-operators to improve building performance and reduce lifecycle costs.

"On behalf of all Bentley colleagues, I welcome Hevacomp users to the Bentley user community and the Hevacomp colleagues to the Bentley team. We look forward to working closely with both to help drive innovations in applications and best practices that will be instrumental in creating the next generation of energy-efficient buildings."

Bentley's final acquisition in January was that of the global business of ECT International, a provider of advanced computer-aided engineering design tools for electrical control systems. The company's flagship product line, promis•e is used to generate electrical system schematics and supporting documentation. With promis•e, Bentley says it will be better able to respond to a growing need among building, plant, civil, and geospatial infrastructure professionals for more comprehensive solutions incorporating electrical wiring, diagramming, and drawing production. ***www.bentley.com***

# Bentley gives Plant Design products Open direction

**Bentley's** Plant products are going Open. That was the news from the daratechPLANT2008 conference, where Bentley announced OpenPlant, the first range of software products for the creation and management of plant infrastructure inherently based on the ISO 15926 data model.

ISO 15926 is the international standard for process plant information which will form the native format for all of Bentley's Plant products in the future. DGN and DWG will still get a look in and users will be able to create deliverables in these industry formats, whilst retaining what Bentley describes as 'persistent intelligence'.

The new products are designed from the ground up to support distributed work groups in single locations or spread over multiple offices. Bentley is also emphasising the benefits of giving control and ownership of data into the hands of the designer and not of the software vendor as users will not need to own Bentley Software in order to open, view and edit their datasets. Indeed, any application that is mapped to the ISO 15926 schema will be able to natively interoperate with



Bentley's OpenPlant products.

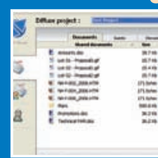
The first product to come out of Bentley's OpenPlant range of products is OpenPlant PowerPID, an intelligent, data driven (or rules driven) Piping and Instrumentation Design package which takes the best features of both AutoPLANT P&ID and PlantSpace P&ID. By daratechPLANT 2009, CEO, Greg Bentley said that he hoped to round out the range to 3D design. It will be very interesting to see if Bentley applies the same 'Open' methodology to other industry sectors in the future. ***www.bentley.com***

## Image competition for LightWorks Users



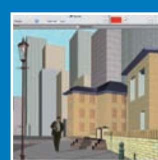
**LightWork** Design, the supplier of rendering solutions for developers of 3D CAD software, has launched a new quarterly LightWorks Image Competition. The Image Competition is open to users of any LightWorks-based application and images may be focused on any market sector or theme. The only criterion is that the image must be created using one of the 80+ software applications which integrates the LightWorks rendering engine, including ArchiCAD and VectorWorks (RenderWorks). The winner will receive an 8GB Apple iPod touch and the best entries will be featured on the LightWork Design website
***www.lightworkdesign.com***

## Abvent offers free project file sharing application



**Abvent**, the developer of the Artlantis rendering application, has released a new application dedicated to sharing and synchronising files between all members of a project. Archigate allows you to distribute your own projects, invite ones from other subscribers and discuss them via a thread.
Archigate can be downloaded free of charge for Mac OS X or Windows XP from
***www.archigate.net***

## Informatix launches Piranesi 5 for Mac



**Informatix** has released Piranesi 5 for Mac OS X, the first Universal Binary release of the specialised 3D painting tool. Piranesi 5 requires Mac OS X version 10.4.10 or later, is compatible with Apple's latest OS X release, Leopard, and also offers native support for Intel Mac.
In Piranesi 5 users will find a reorganised user interface that makes it easier to learn and easier to navigate, but also manages to free up more of the screen space for 'painting'.
There is a whole range of other new features and improvements to Piranesi and its sister program Vedute and Informatix has also provided an extra 200 royalty-free images..
***www.informatix.com***

## Colortrac updates scan-to-copy software

**Colortrac** has released CopySmart v1.3H2, the latest version of its professional scan-to-copy software solution for accurately duplicating colour technical drawings and maps, as well as full-colour, reprographics artwork. CopySmart supports the complete range of Colortrac SmartLF Cx and Gx wide format scanners.
***www.colortrac.com***

## Autodesk completes acquisition of Robobat



**Autodesk** has completed the acquisition of Robobat for approximately $42.5 million in USD cash subject to a working capital adjustment. Robobat is a privately-held company based in Grenoble, France, that provides software for structural engineering analysis, design, and steel and concrete detailing.

***www.robobat.co.uk / www.autodesk.co.uk***

## Graphisoft unveils low-cost ArchiCAD in the US

**Graphisoft** has introduced a low cost, entry-level version of ArchiCAD for architects to the US market, available for $1,995. The new ArchiCAD START Edition 2008 is based on the Virtual Building technology of ArchiCAD 11, but with a feature set and price tailored to the needs of small architectural practices, home builders and contractors. There are currently no plans to introduce this product, which has been available in other geographies for a number of years, in the UK. ***www.graphisoft.com***

## VRcontext updates real time Virtual Reality tool



**VR Context**, a specialist in real-time visualisation software applications for the Oil & Gas, Process Plant and Energy markets, has released Walkinside Version 5.

According to its developers, the completely redeveloped Walkinside delivers a faster, more intuitive navigation of large complex production assets using .NET technology, enabling remote effective collaboration through the internet with online virtualisation tools, accessible even from low-end workstations.

Version 5 offers integrated functionality for contextually linking external applications and databases as well as physical simulation options with human-like avatars that simulate real-world constraints, such as gravity, collision, and relative dimensions etc.

***www.vrcontext.com***

## Open Design Alliance unveils DGNdirect 2.5 beta

**The Open Design Alliance** (ODA) has announced the release of DGNdirect 2.5 Beta available to ODA members. DGNdirect 2.5 Beta is a full redesign and rewrite of the previous ODA DGNdirect libraries. The new libraries utilise an interface similar to the DWGdirect libraries and allow a high level of compatibility between DWG and DGN applications. ***www.opendesign.com***

# Built environment CAE conference

**Simulation Software specialist**, Ansys, is to host what it claims to be the world's first commercial computer-aided engineering (CAE) conference dedicated to the building industry. Providing a forum for the application of engineering simulation technology specific to the industry, the European Built Environment CAE Conference (EBECC) will be on June 5 and 6, 2008. The event will be hosted at Haberdasher's Hall, Smithfield, in London, a city with an almost unlimited number of attractions, including some of the most innovative building development projects in the world.



Featuring presentations and discussions given by industry-leading companies and expert users of technology from Ansys, EBECC will showcase the latest multiphysics simulation technologies and innovations in CAE-related disciplines, including computational fluid dynamics (CFD) for airflow modelling and finite element analysis (FEA) for structural studies. Technology for the fully integrated application of multiphysics simulation to give maximum efficiency and design benefit will also feature.

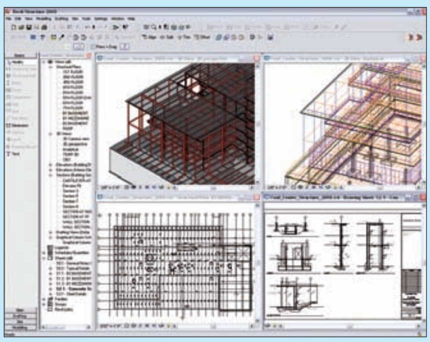
Topics include: Occupant comfort: offices, atria, public buildings, underground trains and stations; Specialist design considerations: seismic response, cyclic loading on structures, cooling of data centres; Wind engineering: pressure mapping, pedestrian comfort, structural loading; Fire and safety: fire modelling, smoke transport, fire suppression, structural resilience; Homeland security: explosion modelling, chemical and biological gas spread; HVAC and refrigeration equipment: fans, chilled beams, facades, diffusers, grills, noise modelling.

EBECC presentations will be designed to address industry requirements, demonstrating how analysis has contributed to design and engineering processes and helped assure that operational performance is not compromised. Papers will be given on specific technologies and case studies that highlight best practice, demonstrating both the engineering and business case for the application of CAE.

The event is designed to attract a diverse range of stakeholders, providing a rare opportunity to network with directors, managers, partners, associates, consultants and engineers from industry-leading companies. As part of the event, an evening dinner will be held on the first night of the conference, set in the dramatic surroundings of the Tower of London.

***www.ansys.com/events/ebecc***

# Revit Structure extends reach of analysis apps



**GSA**, the structural analysis software solution from Arup's software arm, Oasys, now includes a bi-directional link between Revit Structure and GSA. With this Revit users can transfer model information between Revit and GSA with minimal loss of data.

Options are accessed from the External Tools menu within Revit Structure and include facilities to a) export a Revit model to GSA, b) update changes made in GSA back into the Revit model , c) update changes made in Revit back into the GSA model, and d) create a new Revit model from GSA.

Meanwhile, structural engineering software specialist, Structural Integrators, has announced that it is developing an interface between Revit Structure and Staad.Pro. The initial version of the link will be free to registered users of Structural Integrators, and will be a one-way link from Revit Structure to Staad.Pro.

***www.oasys-software.com / www.structuralintegrators.com / www.autodesk.co.uk/revitstructure***

# Super Bowl stadium modelled with Tekla Structures

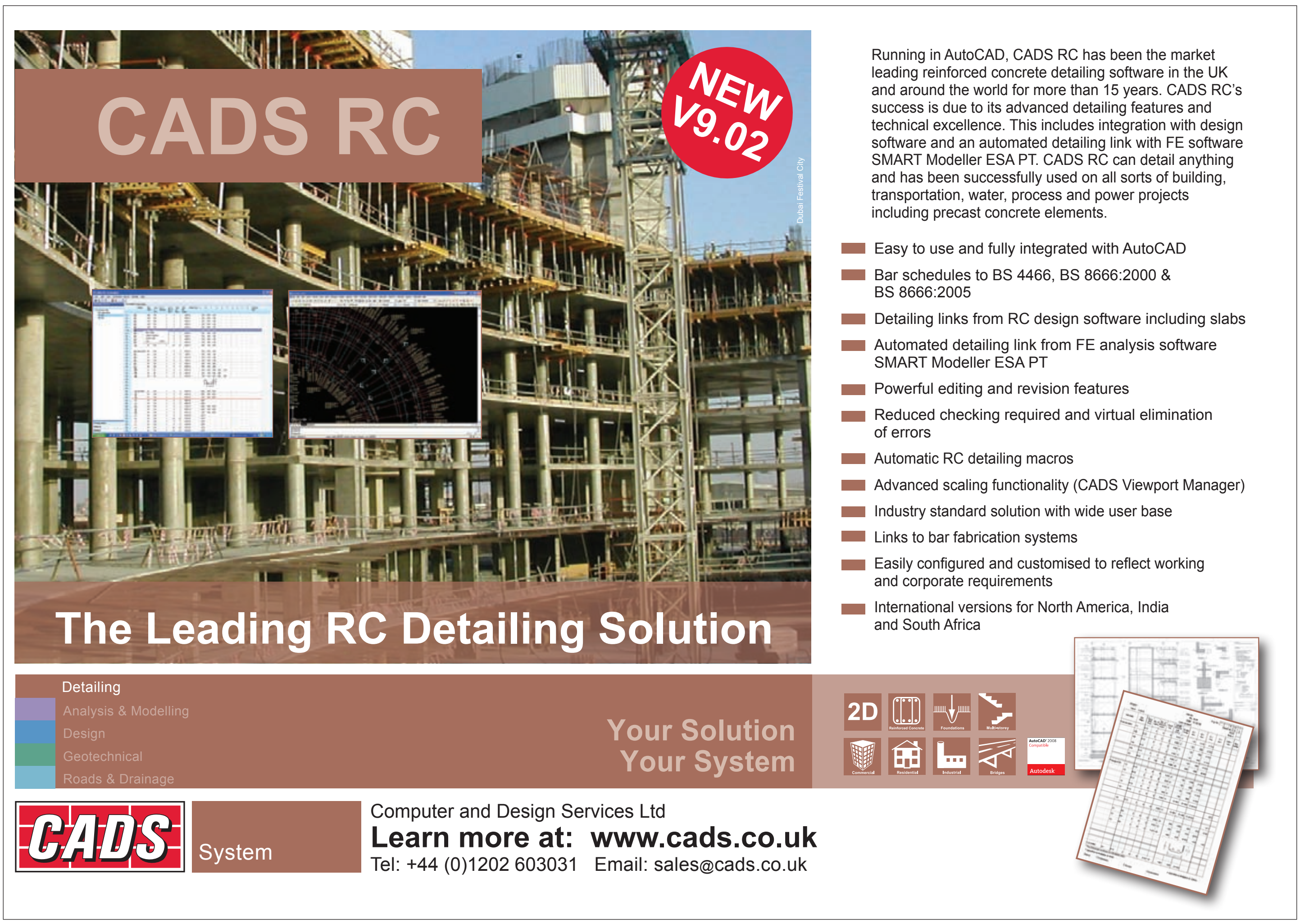
**Tekla Structures** software was used to model the University of Phoenix Stadium, which hosted American Football's Super Bowl XLII on February 2nd in Glendale, Arizona. The software was used to detail the multi-purpose University of Phoenix indoor stadium, which has a retractable roof and roll-out natural-grass playing field. The 63,400-seat facility (expandable to 73,000) encompasses 1.7 million square feet.

The stadium was detailed in Tekla Structures by BDS Steel Detailers on behalf of Schuff Steel Company, who took care of fabrication and erection. Tekla Structures' multi-user functionality allowed numerous detailers to work on the project simultaneously using the same structural model. Advanced 3D rendering facilities, visualisation and reporting tools enabled communicating effectively between all project parties.

Super Bowl XLII was won by the New York Giants who sealed victory over the New England Patriots with a last minute touchdown to make the final score 17-14.

***www.tekla.com***


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Easy to use and fully integrated with AutoCAD
Bar schedules to BS 4466, BS 8666:2000 & BS 8666:2005
Detailing links from RC design software including slabs
Automated detailing link from FE analysis software SMART Modeller ESA PT
Powerful editing and revision features
Reduced checking required and virtual elimination of errors
Automatic RC detailing macros
Advanced scaling functionality (CADS Viewport Manager)
Industry standard solution with wide user base
Links to bar fabrication systems
Easily configured and customised to reflect working and corporate requirements
International versions for North America, India and South Africa
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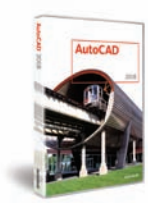
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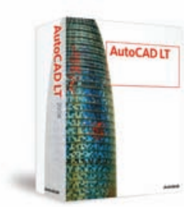


## Autodesk 2008 Product Portfolio



### AutoCAD 2008

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On th 15th March 2008 Autodesk will be retiring upgrades from AutoCAD® 2005, AutoCAD 2005-based products. After this date, technical support will be available only for more recent versions. For more information or to upgrade please visit www.cadpointdirect.co.uk/upgrade

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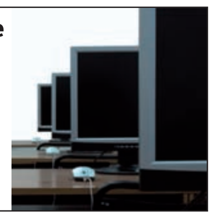
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# Dr. Robert Aish joins Autodesk

**It would appear as though Autodesk** has pulled off a major acquisition from AEC competitor, Bentley Systems. Dr. Robert Aish, Bentley's director of research and 'father' of its Generative Components (GC) technology, is set to join Autodesk's Building Solutions division this month.

Aish was core to the development and promotion of Bentley's parametric form-generating platform, Generative Components, which has been developed on top of MicroStation. Generative Components provides an environment in which geometry (lines, arcs, circles, solids, surfaces) can be given associated relationships, and transformed, generated and manipulated all within a user-defined framework. The product had caused a considerable buzz within the more adventurous architectural design firms, as well as in the structural engineering market - and all while the product was in Beta as it only officially shipped recently.

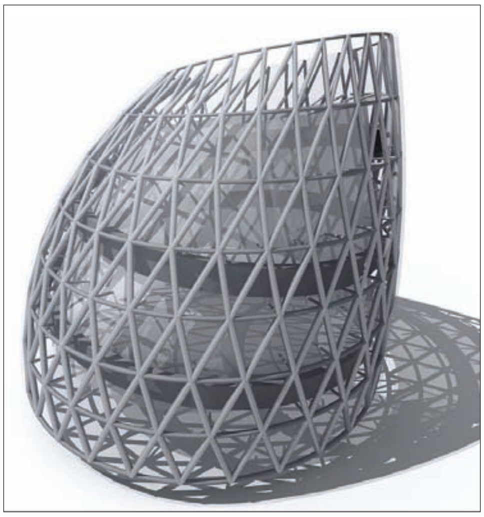
While the technology was impressive, Aish actually took to the road to promote the technology, assisting in the establishment the Smart Geometry group, which provided training for architectural students and key practice designers who required more complex form-generating solutions.

From my dealings with Bentley there was always some reticence when it came to talk about GC's future within the company, as many I talked to didn't understand the impact and traction the technology was creating in clients that had advanced geometry problems. GC was seen as a niche technology for one or two signature architects. However, with the subsequent success of Smart Geometry events and larger than expected take up of the early beta, Bentley started to throw more resources behind GC's development. In fact, there are buildings and bridges in existence and many going through planning that were developed using these early beta code. Aish's departure will undoubtedly come as a major blow, perhaps not in the technology's development, but certainly in the technology's promotion.

Autodesk is a company that concentrates on selling volume products. Under relatively new CEO, Carl Bass, the company is expanding to target Signature architects and high-end industries like Automotive design. However, these are very much low-volume industries. The potential of what Aish had done at Bentley was not lost on Bass. At Autodesk University 2006 there was one customer presentation that included the use of Generative Components in finding a solution to designing a complex bridge structure and Autodesk employees were starting to come to Smart Geometry events to see what was going on. Then just after Christmas 2006, Bass emailed me to say that he had learnt how to use Generative Components and from experimentation thought the software was 'delightful'. Perhaps then, the seed was sown that Autodesk would attempt to recruit Aish or develop something similar.

Aish is widely respected in the construction industry from years of developing innovative CAD systems and has an enviable set of contacts in all the leading architectural and construction firms. It's certain that anything he would develop at Autodesk, would be eagerly anticipated and tested by Autodesk's key target firms.

From talking to Aish, there is no doubt about the passion that he has for generative design, where the computer is the true amplifier of the mind, instead of a mere documentation device. A move to Autodesk would give him the possibility of spreading his technology to millions of designers, in a number of possible applications - AutoCAD, Revit, 3D Studio, Maya or even Inventor. At Autodesk University in Las Vegas in November last year, I talked with Jay Bhatt, VP of Autodesk's Building Solutions Division on the subject of what Robert Aish will do for Autodesk. Bhatt was sure that Aish wouldn't be copying the work that he did at Bentley and making GC for AutoCAD. Future development plans seemed to be very much in the air, with Aish only just having officially joined Autodesk but they do know that he has significant respect within most of the major architectural practices and there's a bunch of very popular applications that he can now choose to develop on top of. Having had many attempts to develop GC at Bentley (the MicroStation platform kept changing), I would hazard a guess that Aish has not given up on what he has been working on for decades. I am sure he will develop some kind of generative technology for Autodesk, although the target platform is as yet undecided. One only has to look at the latest release of McNeel's Rhino to see that form generation is becoming mainstream and Autodesk is aware that it needs to develop that capability.



***Generative Components - N.Y. subway station transit center, by Shane Burger, Grimshaw N.Y. Images courtesy of Grimshaw and Arup.***

Bentley meanwhile has a head start and will need to develop GC at an accelerated pace to get wider adoption and fend off any future threat from what will be a well financed and accelerated Autodesk development.

In fact, Autodesk and Bentley appear to be on collision courses in more than one vertical, now that Autodesk has expanded into developing vertical applications for Geo, Civil Engineering, Power and Process Plant. Autodesk has reverse engineered its own DGN (MicroStation) file format and appears to be recruiting aggressively from Bentley's various vertical sales and product management teams. While in the past Autodesk has appeared a less aggressive industry giant, playing more of a defensive role, the company's recent product expansion and outstanding revenue performance, comes with a new competitive attitude and strategies to single out Dassault Systemes in the engineering space and Bentley in the building and infrastructure for focus. The bottom line of all this development activity and increased competition is that the designer is going to get better, smarter tools, more choice and competitive deals, either being an existing or new customer. **By Martyn Day.**

***www.bentley.com***
***www.autodesk.com***
***www.smartgeometry.com***

# Dassault to take fresh look at AEC sector

**Dassault Systemes,** the CAD giant best known for its Catia product, which is used in automotive and aerospace circles, has set its sights on the AEC sector. CEO, Bernard Charles recently told AEC Magazine that Dassault is set to take on Autodesk on in its home turf, with the development of an AEC produt that would 'be better' than Autodesk's Revit.

DS already has a deal with Gehry Technologies that has had moderate success in getting an AEC flavour of Catia (Digital Project) into Signature architects around the world. And having also partially invested in the original Revit 3D modelling solution, which was then sold to Autodesk (for a large bundle of cash), DS thinks it knows how to make a better AEC modelling tool.

Dominique Florack, Senior Executive Vice President, Products - R&D, expanded on his CEO's vision, stating that the AEC product would probably be based on the new V6 kernel (Catia Lite) and would be distributed as a download, bypassing its obvious lack of AEC resellers. He also said DS was already working with partners to define the product specifications.

With a new dedication to ease of use, powerful shape and form generators, it should be fascinating to see what DS comes up with for the AEC sector. Whatever it is, it is sure to get stiff competition from Autodesk. ***www3ds.com***

# Building performance plug-in for Revit

**IES** has developed a free plug-in to Autodesk's Revit Architecture which provides a direct link to its software and to the company's new architect-orientated Toolkits. The Toolkits are designed to allow architects to undertake top-level building simulation analysis, facilitating sustainable design at the click of a few buttons. This new development enables architects to investigate the building's performance at early stages in the design process without the need to re-input geometry data, and without leaving the Revit environment.

By clicking the IES toolbar in Revit Architecture, the BIM model is transferred into IES software and a dialogue automatically opens. This displays the imported model and provides an easy-to-use method of assigning basic construction and room type properties to the building and rooms as required.

Within Revit Architecture, the Toolkits provide four analysis options: heating and cooling load calculations, annual dynamic thermal simulation for energy consumption, sun view animation for winter, summer and midseason, and a daylighting assessment. Look out for a full review next month.

***www.autodesk.co.uk / www.iesve.com***

# Remodelling an Icon

**The architects and engineers responsible for preserving the icon that is the Sydney Opera House are relying on BIM to guide renovations and manage facilities**

Distinguished by its soaring roof shells, the Sydney Opera House has earned both National and World Heritage status as one of the world's greatest buildings. To meet the dual goals of preserving the Sydney Opera House for future generations and ensuring its continuing utility as a performing arts centre, the Sydney Opera House Trust has adopted building information modelling (BIM) as the core for its strategic building and asset maintenance plans.

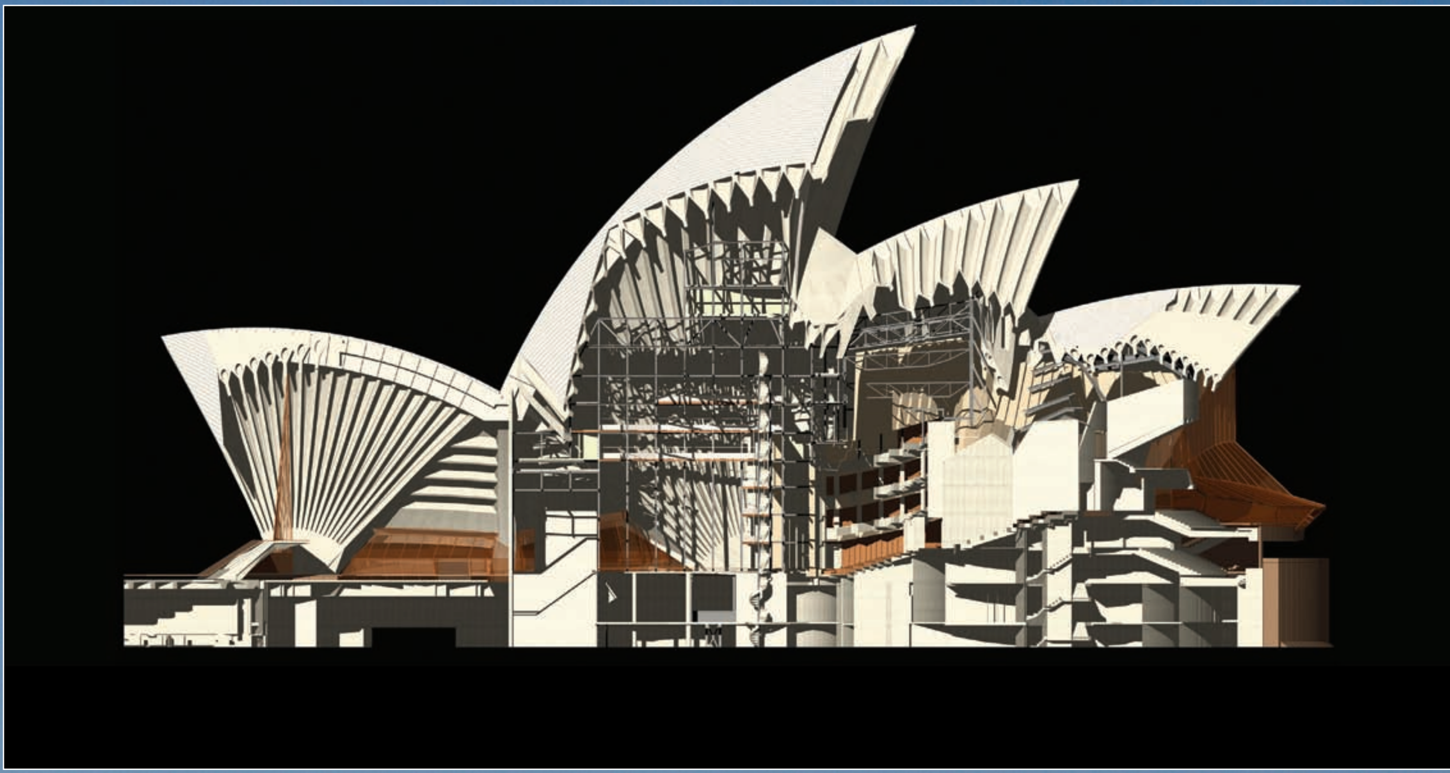
Utzon Architects and Johnson Pilton Walker, in collaboration with a consulting team including Arup, conducted a review and study of the Opera Theatre interior as part of the strategic building plan. The design team included ten engineers, two 3D technicians (architectural and structural), and specialists in acoustics, fire, and theatre planning. The team's assignment was to create a base as-built model for the structural, architectural, and selected MEP components of the building.

The 1,547-seat Opera Theatre is used for opera, ballet, and other dance performances. The record information maintained by the partner firms proved invaluable in creating the Opera Theatre existing-conditions model. However, it took considerable time to sort through the large amount of historical and recent construction documentation to find the relevant information for the as-built model.

BIM forms the foundation for further internal building studies and scheme documentation, ensuring confidence in the redistribution of internal space and existing structural constraints. At the start of the project, the architect and structural engineers used a single software platform - Bentley Architecture and Bentley Structural - to ensure interoperability between their models. Later, MEP consulting engineers Steensen Varming joined the project, using the same software platform.

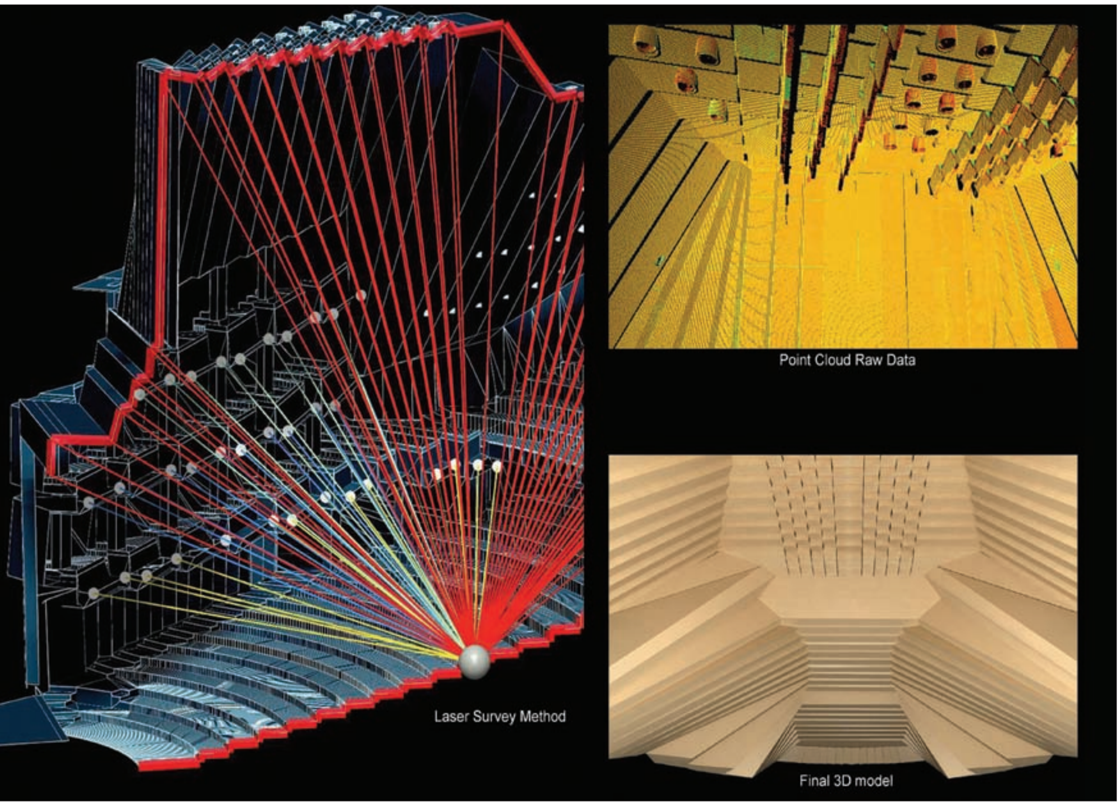
"Early experiments in using other software packages demonstrated severe difficulties in creating the geometry, with less-than-desirable results when creating section files," said Stuart Bull, Arup BIM coordinator. "When the rib/shell structure model was converted into another software package, the file size increased tenfold, making it virtually impossible to manipulate the model."





*Arup created a structural and architectural BIM model of existing conditions for potential reconfigurations of auditorium surfaces within the overall constraint of the shell roof © Sydney Opera House. Courtesy Utzon Architects/Johnson Pilton Walker (architects in collaboration) – Arup*








Because of the complexity of the acoustic panelling throughout the auditorium, the team engaged a building surveyor to conduct a 3D laser-scanning survey. The resulting point cloud, accurate to ±20 millimeters, was converted to a surface model, which became the base model for an acoustic panel model to be used in acoustic analysis software.

–Working concurrently, the structural engineer created a structural model of the auditorium bowl. The 2D and 3D survey data was constantly reviewed to identify instances where as-built information might give misleading results and require reinterpretation. Engineers also modelled the existing primary mechanical duct runs in and around the Opera Theatre auditorium to help determine where new plant rooms and duct runs could be located.

## Model payoff

Once the combined structural and architectural model of existing conditions was complete, designers could carry out a range of potential reconfigurations of the auditorium surfaces within the overall constraint of the shell roof. The as-built model proved invaluable in documenting proposed redesign schemes. Team members could easily view where new structure was introduced, where existing structure remained, and how high-level work would relate to the underside of the shell roof.

The as-built model was then used to assist in acoustic and fire simulation analysis, evacuation planning, and egress modelling. BIM information was transferred via IFC 2x3 format, or by simple DXF to non IFC-compatible analytical packages. Arup has performed significant experiments using IFC 2x3 for extensive data exchanges.

A recent addition to the Opera House, the western foyer colonnade was fully modelled in advance for construction documentation. This approach will be used for further work planned for the western foyers, which run almost the entire length of the west side of the Concert Hall. The design team found that the 3D BIM saved hours of work when creating construction drawings.

For example, 200 separate section files were created overnight when documenting the western foyer upgrade. Other planned renovations include the addition of an elevator via a new tunnel at level one beneath the western boardwalk to provide access to the box office at level 30. Future proposals include for the Opera Theatre orchestra pit to be extended and the auditorium refurbished.

The Opera House has long had challenges following the paper trail of structural and architectural documentation for all parts of the building. In conjunction with BIM, Arup also introduced a system for tagging drawing information. Structural and architectural components were assigned invisible tags that contained descriptions of the source of drawing information for that element. For instance, a wall tag contains its unique number from the original construction drawing documentation as well as associated reference information.

A custom script can then be used to generate reports listing the information in the component description tags. The reports are in HTML format with hyperlinks to a previously created CD of all Opera House structural and architectural drawings in TIFF format. "The model thus becomes a drawing library as well as a documentation model," said Bull. "No more tedious searching through drawing registers for the correct component drawing."

Another key benefit of the BIM process was the linking of the structural model directly to the Opera House master door schedule. Considering that the Sydney Opera House has 2,200 doors, a significant amount of time is saved by providing quick access to building information. The benefit of this integrated process, said Bull, is that the model can be used for both documentation and building management, creating a powerful interactive window between the physical model and the building information data sets.

***Because of the complexity of the acoustic panelling throughout the auditorium, the team engaged a building surveyor to conduct a 3D laser-scanning survey. © Sydney Opera House. Courtesy Utzon Architects/ Johnson Pilton Walker (architects in collaboration) –Arup.***

The door schedule contains information about fire compartmentation, space designations, and functional use of the space. Arup established a direct link between the model and the master door schedule database by attaching the official door number designation in the master door schedule database to the unique identifier tag in the structural model door component. This makes it possible to locate a door number in the external facilities management database and immediately view all information about the wall containing that door, as well as space compartmentation data and all asset and facility management information.

This system is bidirectional - it works from the BIM model to the facilities management database and from the facilities management database to the BIM model. Future links will connect directly to facilities management asset management software. The ability of the Bentley products to use VBA to link to Excel spreadsheets and external databases proved extremely important in Arup's facility management investigations.

Currently, the Opera House Facilities Management Group is looking at designing an intranet system that will use the continually growing 3D building model as its backbone. All information held by the Opera House and generated by external consultants and subcontractors will be stored in a central server database. Opera House staff, external consultants, and contractors will be able to access this large composite set of building information. This system will also allow data mining that may reveal seasonal trends and permit earlier identification of potential operational problems.

With this BIM-based system, the Opera House guardians will be well positioned to modify the building to meet changing needs while preserving the unique characteristics that make it a national and world treasure. Thirty-four years after its completion, the Sydney Opera House remains a pioneer of innovation.

*Courtesy of Utzon Architects/Johnson Pilton Walker (Architects in collaboration), Arup, CRC for Construction Innovation, Hard & Forester (Surveyors). Visualisations by Wayne Dickerson, Associate JPW*

***www.bentley.com***

# Continued success for CADline



**CADline Ltd., the Autodesk Premier Solutions Provider has reported record Q3 results with year on year sales growth in excess of 40%.**

Claire Bass, Sales Director, says "the company is seeing the results of on-going investments in staff, infrastructure and a service-orientated business model. This coupled with business coming on-stream from new offices in Southampton and Bristol is now having a significant effect and will continue throughout the year with two new offices and training centres planned to be operational in January."

Following the launch of Midas Technology by the CADline board of directors in January 2007, CADline clients can now benefit from the latest Autodesk Mechanical Solutions. This puts both businesses in a unique position to offer its clients a full range of architectural, engineering and manufacturing products ensuring that an end to end industry solution is provided enabling true project collaboration.

With unparalleled enthusiasm from staff, unrivalled customer loyalty and continued investments in customer services and technical resource, CADline is looking forward to strong growth and maintained profitability in 2008.

# Going green with digital archives

When building contractor Lakesmere needed a digital archiving solution it turned to a portal-based technology from Union Square Software.

As a building contractor Lakesmere is used to the prospect of creating space, so the company had to think creatively when faced with the prospect of losing over half the building space that it had previously allocated to archiving paper files. Legal requirements insist that some of Lakesmere's documentation has to be retained for up to 12 years, but the company estimated that it was costing between £300,000 and £400,000 a year to process paper-based documents. As a solution to this problem, Lakesmere turned to portal-based technology from Union Square Software.

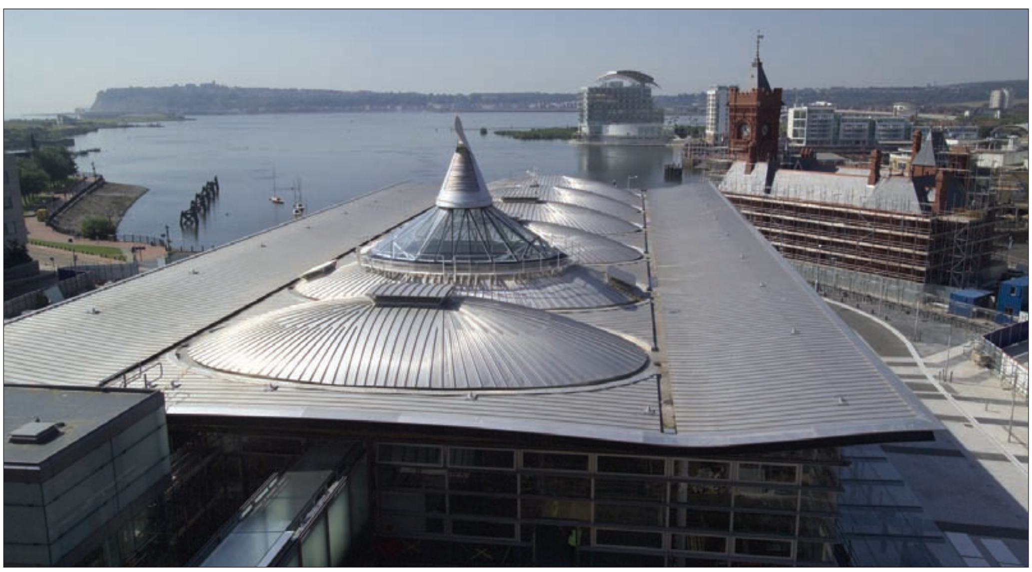


***Lakesmere projects: The Diamond synchrotron research facility located in Oxfordshire produces a very bright light which can be used to look at the atomic structures of molecules such as proteins.***

Lakesmere is one of the largest specialist building contractors in the UK, excelling in the design and installation of external building fabric – roofing, cladding, glazing and other architectural features – and the use of modern high-tech materials. With turnover of over £44m, Lakesmere works in conjunction with key clients such as Costain, Laing O'Rourke, Carillion, HBG, Mowlem, Bovis and Taylor Woodrow. High profile projects include Spinnaker Tower, the National Assembly for Wales, the Diamond Synchrotron research facility, Farnborough Airport and Glasgow Fort Retail Park.

Following a major refurbishment of the Lakesmere Winchester headquarters, and the creation of a new meeting room the company lost over half of the space that had previously been allocated to archiving paper files. According to Geoff Dennis, Finance Director, the process of clearing out old paper files made the company think seriously about how it should save and store the huge amounts of documentation and drawings that arose from each of its building projects. Legal requirements insist that some documentation has to be retained for up to 12 years, while other paperwork can be disposed of after six years and some is transitory. "We needed an answer and yet looking at document management systems all they offered us was the capability to store our paperwork electronically," explains Dennis. "Something we could have created ourselves with a server and a database. We wanted more, and yet at the time we didn't really know what we were looking for."

Over the years the company had built up resilient processes and procedures that worked well and were supported by a number of electronic systems. "Our procedures were robust and in accordance with our policies and quality system," says Dennis. "However each department had built its own set of databases and there was a lot of duplication as well as manual paper processes – it was time consuming and while it worked it wasn't always the easiest way to do things."



***Lakesmere projects: The National Assembly for Wales.***

Having spent quite a lot of time in the archives sorting things out, Dennis and his team realised that every piece of paper has a finite life span the end of which could be determined – whether 12 years for legal reasons or straight off the photocopier into the bin. "We also realised that there was an enormous cost associated with handling and processing paper documents, much of which could be eliminated if we held them electronically." The sums were astonishing; Dennis and his team estimated that it cost between £300,000 and £400,000 a year to process these bits of paper. "We looked at everything from the cost of opening the packet of paper to throwing it away in the bin at the end of its life and came up with some amazing calculations," says Dennis. "Admittedly there is a cost attached to managing it electronically, but it is much lower."

While discounting document management systems, Dennis stumbled across Workspace from Union Square. "It wasn't really what we had in mind; however I immediately saw the benefits and opportunities for Lakesmere. Centralised databases with all project information and documentation as well as company data available for anybody to access from anywhere. I didn't know any application like this existed."

Workspace has been rolled out across the Winchester, Warrington and Glasgow offices and more recently in the new Birmingham premises. In order to ensure that the benefits of Workspace were immediately visible, Dennis and his team spent a considerable amount of time working with Union Square consultants customising the application with

their processes. "With the help of Union Square we were fortunate in pulling across a lot of our existing information – much more than we initially expected. For the paper processes, we managed to duplicate those within the Workspace environment," says Dennis. Every document produced or received from a supplier is now automatically created or captured within the Workspace environment. One central database now holds all supplier, sub contractor and contract details and the Winchester and Warrington offices use integrated telephone systems that allow contacts to be dialled simply by clicking the details in the Workspace record.

"Workspace is used for as many of our everyday activities as we can think of," says Dennis. "Electronic site diaries record who is on site and when, and the plant register tells us what equipment is present at any time. In addition we have an asset register module that keeps tabs on company owned equipment including cars, laptops and small power tools. If you need a piece of kit it's now very easy to find out who has one."

Training is a key component of the work at Lakesmere and Workspace's Training module has been used to record the training requirements for both employees and subcontractors. Recording which courses have been booked and whether passed or failed, the system produces individual training records which are linked to the corresponding certificates so that they can be accessed from site when required. In addition, the system also flags up when qualifications expire or refresher courses are needed.

When a problem arises – anything from a late delivery, incorrectly produced material or a design problem – the Lakesmere Quality Management System requires a non-conformance report (NCR) to be issued. Previously a very protracted manual system was used. Now installed within Workspace, NCRs can be issued, circulated and dealt with easily, saving at least £150 in processing time for each NCR. "We are generating more NCRs because the process is a lot easier to do, but the result is that our overall quality is improving. Now even the trivial things get reported and fixed," says Dennis.

Managing the delivery of goods on site is a common problem for contractors. Previously, orders and delivery details would have been put in the post to site managers, often arriving after the goods. Now Lakesmere's site managers simply click on a tab to see exactly what has been ordered and when it is scheduled for delivery. Actual delivery dates and delivery note numbers can be added to create a complete order record that can be accessed by finance prior to payment.

"Workspace represents a new way of managing the business and brings everyone together," says Dennis. "Different departments use different bits of it, but the fact that you can access information more readily from anywhere saves enormous amounts of time and makes us all more efficient."

Standard templates mean that Lakesmere no longer order specially printed stationary and paper usage has gone down by 20% despite turnover and workloads increasing by 30%. "While postage costs have gone down by 40%, the biggest saving isn't money, it's our time."



***Lakesmere projects: Xscape in Braehead, Glasgow houses an indoor ski slope and leisure complex.***

With 185 Workspace licences spread across four offices and up to 20 live construction sites, managing the flow of information for Lakesmere has never been easier. "The beauty of Workspace is that it is almost limitless and you can carry on finding new things to apply it to. Every week somebody here at Lakesmere comes up with a new idea," says Dennis. Currently beta testing a drawing management module for Union Square, Lakesmere has a pipeline of further developments already planned for Workspace.

"With Workspace and the support of the Union Square team we have succeeded in doing everything and more than we wanted. Workspace is an excellent product and we are now achieving most of the productivity gains that we anticipated, plus significant financial benefits."

***www.unionsquaresoftware.com***

SmartGeometry

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# Best seat in the house

A new polygonal modelling add-on for Rhino gave furniture craftsman Peter Donders, the control he needed to bring a 1913's seat design to life as part of a major project to return Blackpool's Grand Theatre to its former glory. by Brett Duesing, Strategic Reach

Blackpool's Grand Theatre has been the centrepiece of Blackpool's Art District since 1894. And today the 1,100-seat Victorian auditorium continues to function as the town's community theatre, Lancashire's preferred opera house and Britain's National Theatre of Variety.

Restoring the structure to its former glory involved some unusual challenges – one of which was replacing the seats. Jezet-Seating was contracted to the task, but could not find auditorium seats in the commercial market that matched the Grand Theatre's distinctive turn-of-the-century opulence.

The solution for the thousand-chair order involved the commission of Belgian furniture craftsman Peter Donders, who was not only familiar with traditional methods of chair-making, but was also savvy in the computerised art of 3D industrial design. To make new chairs look convincingly antique, Donders uses a 3D method for product development called T-Splines for Rhino.

## The chairman

"After much research and development, we produced a new seat based on a design by A. R. Dean of Birmingham, circa 1913," explains Donders. "I came in around September 2006 for the 3D design and produced the chairs in about nine months. The seats have cast stanchions with beech-frame backs and swabs."

Donders started his career making single custom

### Seating design workflow



**1.** *Start with a mesh box.* **2.** *Convert to T-Splines.* **3.** *Extrude legs* **4.** *Extrude back* **5.** *Extrude rockers* **6.** *Add in arm rests and a decorative head cut-out.* **7.** *If the arm rests are too high, they can be repositioned by merely moving the control points.* **8.** *Curve rockers, armrests, and other features and recline back.* **9.** *Rendered using vRay in Rhino.*



*The Grand Theatre in Blackpool, UK, required 1,100 new Victorian-style seats for its restoration. JEZET-Seating was approached in 2002 to supply the new seating for the theatre, but the company found there was no suitable period seat commercially available.*

chairs by hand. Now through use of 3D production methods, he designs seats that fill whole theatres and stadiums. For the Grand, Donders composed the chair design in Rhinoceros, a 3D CAD modeller best known for its ability to generate curved surfaces with pinpoint accuracy, as mathematic equations called non-uniform rational b-splines, or NURBS.

Unlike 3D modellers used solely for virtual content like animation or film effects, Rhinoceros' outputs are attached to precise real-world measurements. The 3D data guides automated machines like laser cutters, CNC mills, and 3D printers to quickly manufacture new products.

"I had some 15 years experience as a furniture designer and builder before I ever even considered using computers," says Donders. "Nowadays, using the computer is pretty much like using any other tool that facilitates the design and development process."

## T-Splines for Rhino

Last year, Donders discovered the beta of the T-Splines plug-in for Rhino "just in time" for his Grand Theatre project. The program operates inside the surface modeller, and gives Donders and other industrial designers a tremendous enhancement in modelling flexibility.

"Rhino is well known as an excellent free-form surfacing package. What T-Splines brings to Rhino is the ability to have even more organic shapes," says Matt Sederberg, CEO of T-Splines, which developed the plug-in. T-Splines leverages both NURBS, and what's called polygonal or subdivisional surfaces, to generate shapes. Polygonal modelling is common in modellers for advanced animation, but until now has not been accessible to those who build products.

"Pixar uses polygonal and subdivision surfaces modelling technology to create 3D animated characters," Sederberg explains. "A lot of industrial designers have started to look towards this type of modelling because it's much easier to get a nice complex surface with smooth transitions between features."

Rhino produces NURBS that start out as rectangular planes, which then can be bent and tweaked to form the curve the designer wants. To make an irregular form that is a self-contained volume, designers typically have to panelise the form with a patchwork of NURBS. With T-Splines, on the other hand, designers can use polygonal or sub-divisional modelling techniques, beginning with a 3D volume that can be stretched, extruded, and twisted, while maintaining the volume's continuity.

"With T-Splines, we can make a non-rectangular shape that is one surface and smooth everywhere," says Sederberg. "If we made this shape in Rhino without T-Splines, we would have to spend a lot of time making sure the edges of composite surfaces patch together correctly without gaps or misalignment. 'You don't have to deal with patches.' -- that's just a few words, but that's essentially what T-Splines mean to Rhino users. It's a huge time-saver."

There are a host of polygonal based modellers already on the market, according to Sederberg, including brands like 3ds Max, Hexagon, modo, and Silo. The limitation to these applications has been that they produced pretty pictures – animation, film effects, or video-game scenes – but could not be linked to NURBS, which product designers use to communicate geometry to factory machines. Through T-Splines in Rhino, these two separate modelling methods are finally linked in tandem. Polygon-produced shapes can now be produced as real-world objects.

"T-Splines is the first program to actually do that polygonal modelling in a way that's compatible with NURBS," he says. "With T-Splines, you can easily get very complex geometries, and in the end be able to manufacture it."

## Stanchion production

Donders' chairs give an excellent example of how





polygons and NURBS can now come together in a design process.

"Many of the chair parts are surfaces that Rhino can model very well all by itself," says Sederberg. But one highly detailed part - the ornately curled stanchion under the arm of the chair - makes it a prime candidate for polygonal manipulation.

"I don't think you would even dream of modelling something like that in Rhino. It's something that's easy to model in the T-Splines plug-in, but for someone who's already familiar with polygonal modelling, it's also easy for them to model the entire shape in a polygonal modelling application."

Donders modelled the stanchion in a popular polygonal modelling program called Hexagon, and then brought it into T-Splines in Rhino, where he seamlessly converted the shape to NURBS. "It's just a push-button operation to convert the data. Without additional work or editing, the designer has an extremely complicated ironwork design ready for fabrication," says Sederberg.

"The Blackpool project focuses on one aspect of the T-Splines plug-in – the ability to convert low-polygon-count meshes to T-Splines inside Rhino, so that the form can be



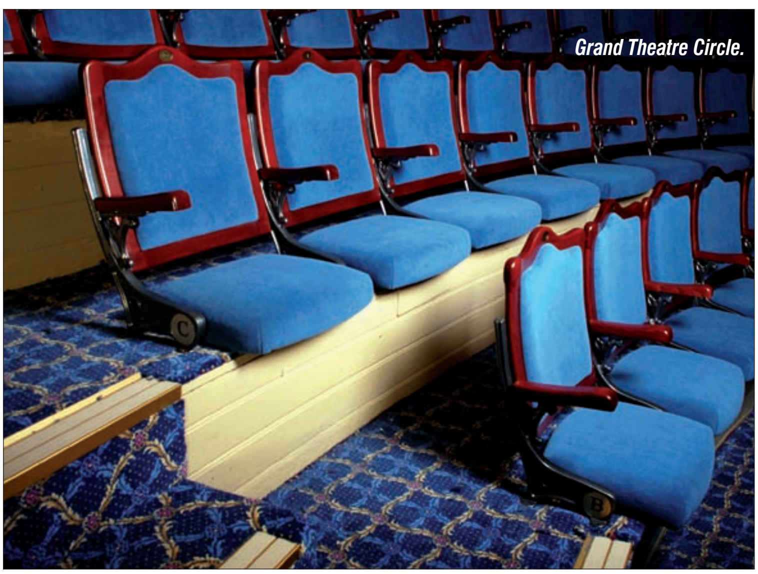
***The final NURBS computer model is sent to automated CNC mills via IGES files to cut the prototypes and ultimately the moulds for 900 PC aluminium casting.***

manufactured," Sedenburg says.

As for the Grand Theatre, the audiences are now seated in style after the completed restoration. Donders may have stumbled upon something big with his revival design. "The architect who built the Grand in 1894, Frank Matcham, built almost 30 other public auditoriums and music halls throughout the UK," says Donders. The popular appeal of Matcham's theatres has spawned a national society to preserve his work. Donders has just received orders for hundreds more chairs - to fill rows in the Royal Hall in Harrogate, as well as another location in the West End of London.

*The T-Splines plug-in for Rhino version 1.0 was released in September 2007, and is now available through the company's website, or through various Rhinoceros resellers. The module contains a suite of polygonal modelling and surface building tools, along with the flexible data translation capabilities for models from other applications.*

***www.peterdonders.com***
***www.tsplines.com***
***www.rhino3D.com***



***Grand Theatre Circle.***

# Green buildings with Ecotect

There is a lot of talk about green building design and many architects are coming up against design-related criteria of Part L. WIth building performance becoming key, Martyn Day evaluates a low-cost solution that could be the answer to better building design.

I originally came across Ecotect when evaluating the last release of Graphisoft's ArchiCAD. Graphisoft has managed to gain the distribution rights to the program and has also integrated the two products to speed up geometry import. This month, I've had a more in-depth exploration of Ecotect and it's really a swiss-army knife analysis tool with great visual feedback to quickly analyse a building's performance in a number of key areas.

We usually leave the price of the software to the end of the review but at £850 per seat, I think it's worth mentioning at the start, for as we work through its capabilities I am sure many will assume that the software will cost thousands of pounds. At this price, I don't see any reason why even the smallest of practices couldn't justify a copy. That said, the software covers areas that are highly technical and specialist knowledge would be of some advantage but this isn't something that couldn't be overcome with a little training.

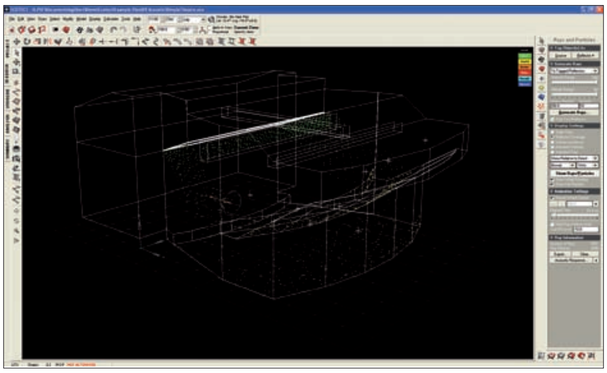
The beauty of Ecotect is that it can be used at every stage of the design process, from defining the maximum site envelope or testing the conceptual model, to nailing the details and refining solar performance and acoustics. The more information you can give the system, the better the results. It also provides an environment with which to test out the impact of material variations, should that be thermal or acoustic. In the case of glazing the software will even generate an ideal case, Part L compliant model from the original design - showing just how far you are out.

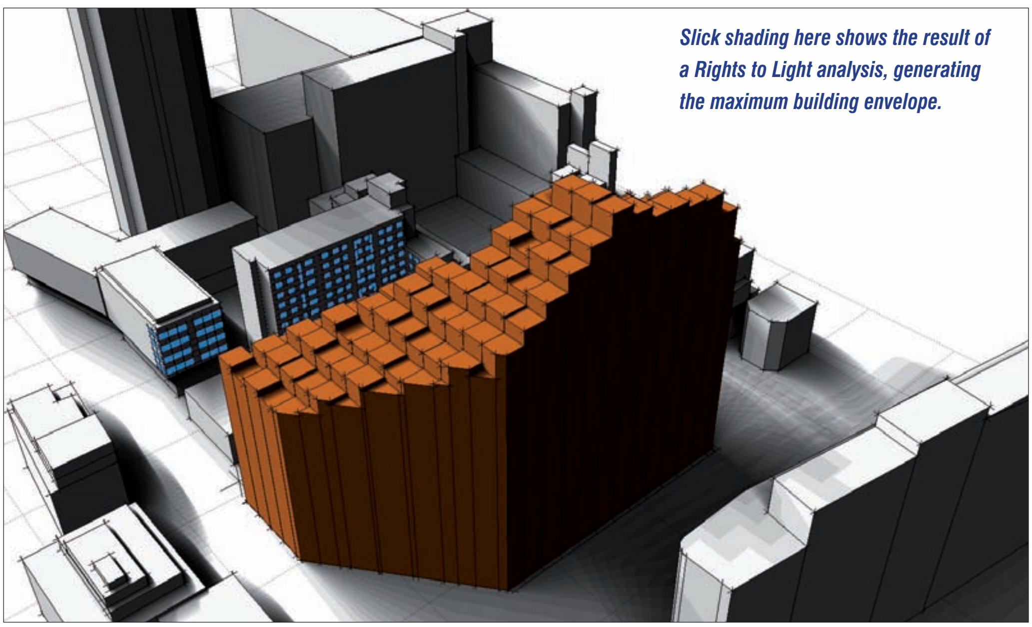
## Geometry

If you were having trouble justifying a move to 3D, performance analysis and Ecotect are the very reasons that designing in 3D makes sense. The first part of the job is to get your model into Ecotect. The software has its own basic modelling environment that you can have a crack at but it really isn't as intuitive as a CAD system and is best used for generating basic layouts. Although, you can switch between different views of the model, such as orthographic or axonometric projections, and a nice visualise feature shows the model in OpenGL, the issue is that the views aren't in sync, so model view manipulation is on a per window basis.

There are a number of import options including 3DS but this just imports dumb geometry and all the areas still have to be defined and zoned. This is where ArchiCAD has the advantage as its models come in automatically zoned - with the exception of overlapping geometry conditions which have to be resolved for the analysis engine. Here, if a window runs between zones or there are multi-storey components, these have to be identified or altered. For instance a ceiling on the first storey is a floor to the 2nd storey.

*Here we can see the acoustic rays travel and bounce off surfaces within the mode. Each changes colour on each bounce to show generation and whether it's good or bad.*





*Slick shading here shows the result of a Rights to Light analysis, generating the maximum building envelope.*

The Ecotect modelling environment can make element selection difficult on complex zoning, and using ArchiCAD for the original model definition speeds up this process. It may even be worth owning a copy to generate the concept models to feed into Ecotect and cut the prep work. Once these have been identified you are ready to start building up the material definition of the building, what's it made out of, where it is on the planet, its orientation, what time of day it is and what month you are interested in.

## Materials and environment

The most important part of analysis is making sure the software has enough information to carry out a meaningful calculation. For instance, the walls, glazing, and partitions all need to be assigned materials for any thermal analysis and the software comes with a big library which prove all the U values and numerical characteristics that the analysis equations need. Cooling systems and plant should be added here too, providing Ecotect with any man-made environmental measures that have been anticipated. This can be a laborious process but it's just a case of selection and allocation in the dialogue. If the materials aren't present or a value needs tweaking, it's easy to go in and edit. I suspect at this stage, a little knowledge goes a long way as errors here can skew the result. It's best to start learning the software on simple models and guesstimate the results. It's always good to have a certain expectation of the output before you start so the end result is logical. Never take computer analysis output as gospel.

The site conditions matter too and here you carry on building data for your model analysis. Enter the model's orientation and position on the planet (by latitude and longitude, time zone), there's a built-in weather data file which provides yearly average environmental conditions against which the design should be tested (you can import your own too). This is used for thermal and ventilation calculations.

Now with your model zoned, materials allocated and environment and global position assigned, it's possible to start running some calculations to get a wide range of performance characteristics, including solar radiation, right to light, over-shadowing, conformance to Part L, light penetration, ventilation and many others.

## Analysis

With the weather data loaded, and orientation defined, Ecotect can provide a very visual display of the prevailing winds around the building all year. This basic info could assist in designing cooling and natural ventilation systems. This also expands to average max and min temperature, humidity and rainfall. There are links out to Computational Fluid Dynamics (CFD) engines too, so you can really 'see' the airflow and forces that your building is likely to undergo.

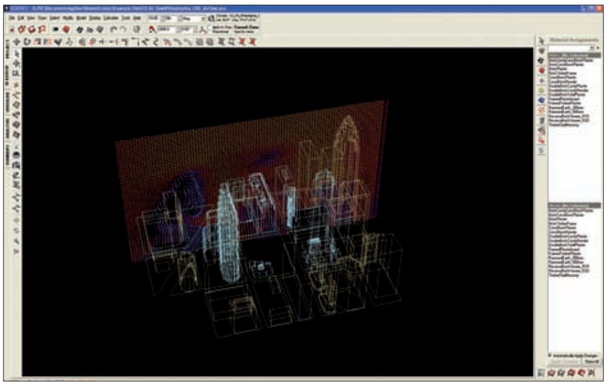
The Solar components in Ecotect are amazingly useful, producing the shadows cast by the model at specific times, or throughout a specific day of the year. There is a very accurate model of the Sun's path that can be moved in real time, casting shadows. Throughout any day, you can analyse the light penetration into your building and place this against building conformance. This feedback will also prove effective in ceiling lighting design, or window placement. The reverse of this is used in the program to design building envelopes - it's possible to calculate the maximum envelope of a building on-site that would provide the statutory rights to light for adjacent buildings. It does this by analysing rays from the Sun model and you actually see the envelope refine and form in the analysis. It's also great to use this tool to analyse the visibility from your model, resulting in a colour map of a city which will show what's viewable from preset locations and heights.

In fact that's one of the main beauties of this program - the visual feedback of the graphics. More often than not the analysis visually indicates what part of the building it's computing on and these can be dots or arrows (for acoustic). The results are typically shaded into the model design, giving very clear indications of the building's performance.

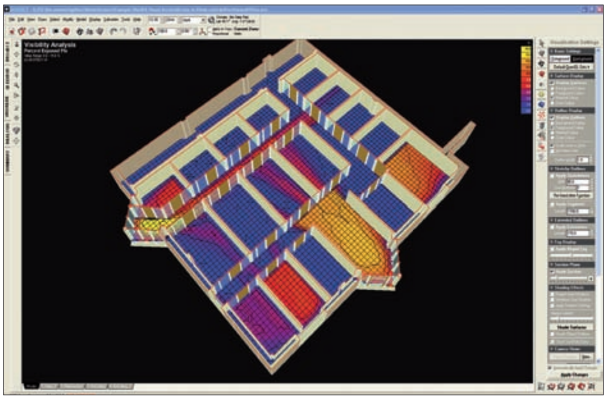
It's also possible to import a model, for instance a facade with louvres, and analyse the performance of the screen at various times of the year to aid optimisation of the louvre coverage. Again a coloured map of energy absorption is projected on the building and louvre design. The solar dynamic of a building and its orientation is also of increasing importance in designing natural ventilation and attaining low carbon emissions.

The acoustic analysis is straightforward and relies on the faces and materials within a building. Again, this is very interactive and rays are sprayed from a point in a building and it's possible to see echoes as they hit surfaces. It's possible to then consider altering faces and materials to aid absorption and remove unnecessary reverb.

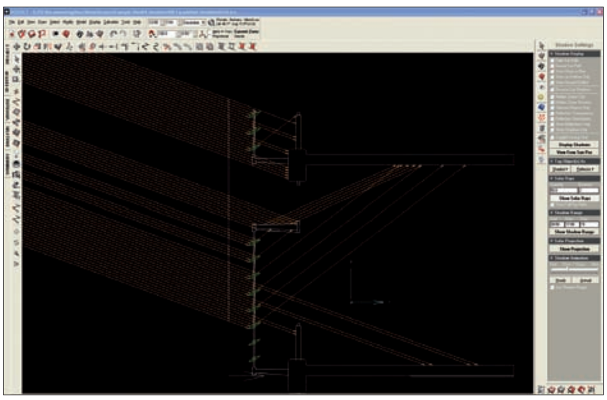
Feedback need not only be seen on the model but Ecotect outputs a plethora of graphs, which provide a bigger overview of the building's performance over time. These are useful to see the differences in designs, or to compare against reference curves in all kinds of criteria - handy when optimising a building's yearly performance and seeing where there are problems and at what times of the year. This can lead to more specific analysis of the model using a selection of the analysis tools to better understand the problem.



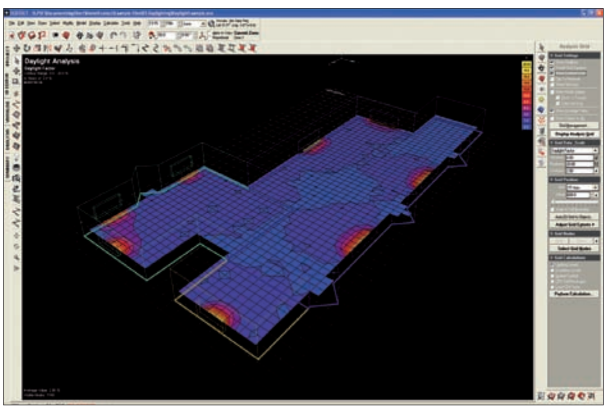
***This shows the result of taking an Ecotect model and performing a CFD analysis of the air movement around the building within its city. The model is completely 3D and can be sliced vertically and horizontally.***



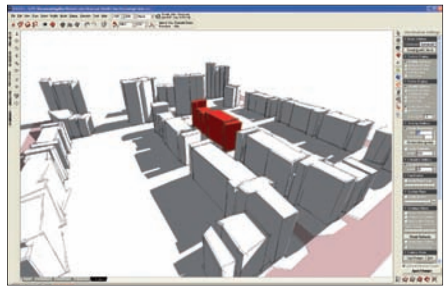
***This shows visual feedback on the natural light penetrating a structure. This can be used to refine the design to get more natural light into the core of the building, reducing the need for artificial systems.***



***Ecotect does have some 2D output as well. Here the 2D rays from the sun hit a cross section of a building with louvres. The resultant light entering the building is shown.***



***Ecotect's natural daylight analysis results are very visual and offer instant assessment of a design.***



***The building in red is being analysed for overshadowing in a city environment.***

The big analysis is that of compliance with Part L, conservation of fuel and power parts 1 through 2a. Here, through easy, step-by-step wizards, Ecotect takes into consideration many different aspects of a multi-zoned, multi- floor building, from glazing to ventilation systems, to thermal transfer (gains and losses). Ecotect performs full Elemental, Target U-Value, Whole Building and Carbon Emission methods of Part L. The calculation produces a large table with all the results indicating a Part L pass or fail and will indicate exactly where the failures occur. The software can even generate a compliant reference module, based on altering the glazing to pass. While you won't take the reference model, it actively and visually shows you how much glazing you have to lose to get accredited.

The team is currently developing a LEED compliant version. As surfaces and materials are entered, it's also possible to add in cost and therefore get feedback on the actual cost of the building. Ecotect exports to; RADIANCE, POV Ray, VRML, AutoCAD DXF, EnergyPlus, AIOLOS, HTB2, CheNATH, ESP-r, ASCII Mod files, and XML.

## Conclusion

Ecotect really puts something in the hands of architects that empowers better building design, so long as you can understand the concepts. With the movement towards naturally ventilated, low power, low emission designs, the performance of any structure and system will become absolutely paramount in gaining planning permission and compliance for possible tax credits.

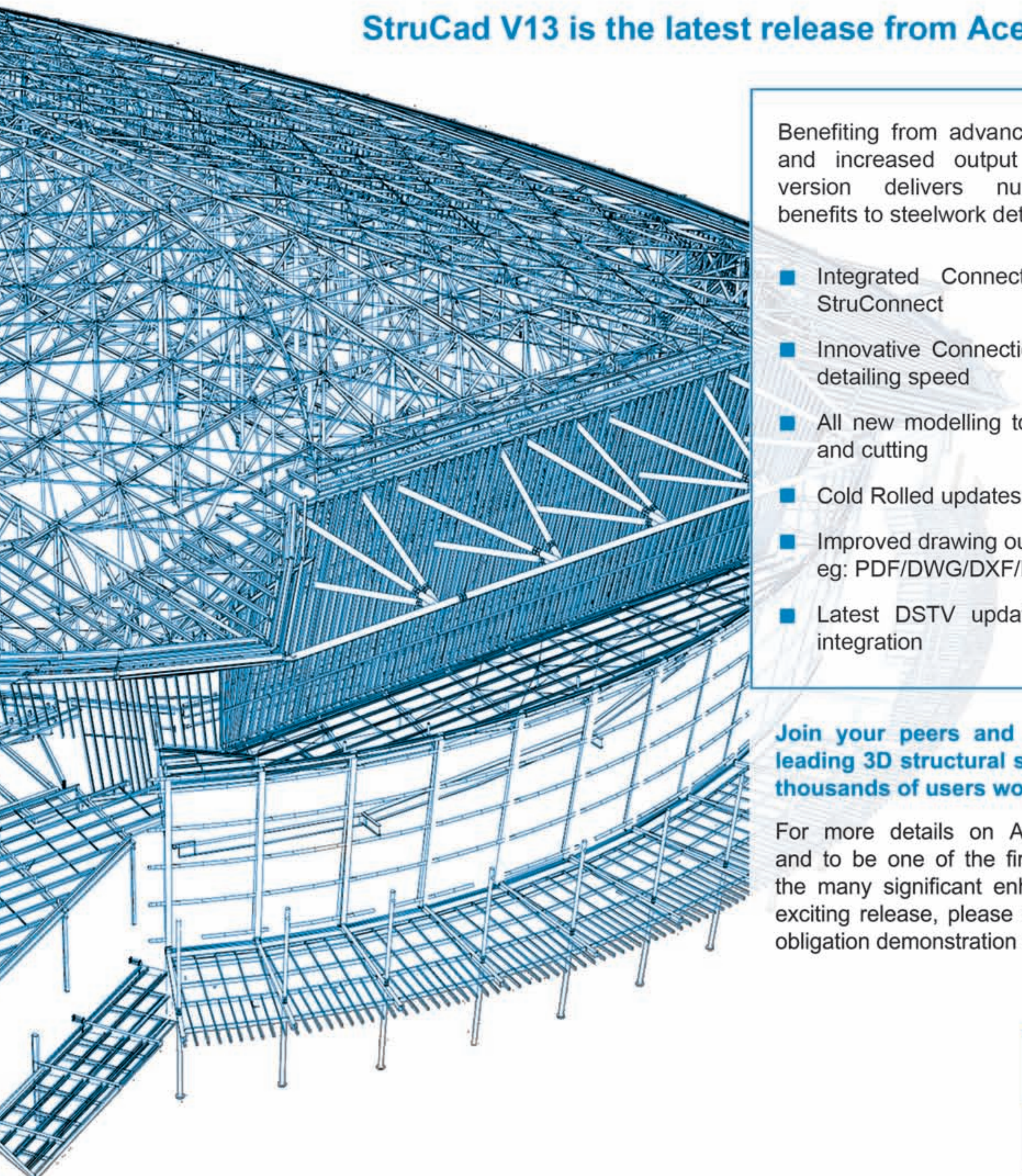
The main pre-requisite is some knowledge of 3D - you can use the built-in modeller, import a dumb file or utlise ArchiCAD data. The system acts to give great visual best estimates and can be used to really drill down to generate the best performing design. I assume that over time and with a lot of use, users will become experts in understanding the design criteria and materials that give the best value and compliance, leading to fewer analysis cycles.

At £850 per seat, this is essential, forward-looking technology for any architectural practice and will hasten a move to 3D. Forget 3D for the sake of co-ordinated documentation, 3D is all about better building design.

***www.squ1.com***
***www.graphisoft.co.uk***







# Embracing change with Revit Structure

For the structural design of One New Change, a seven-storey, mixed office and retail redevelopment in London, Arup adopted a 3D process with Revit Structure.

"With substantial 3D experience behind us we jumped at the opportunity to use BIM on a large, high-profile project with a tight deadline. Although complex and challenging for a first project on new software we were very pleased with the result," says Jim Williams, Arup structural CAD manager.

Williams is describing his first experiences of working in Autodesk AutoCAD Revit Series – Structure, the new structural modelling and drafting software. As he admits, "to trial it on a 1m sq ft mixed construction building situated directly opposite St Paul's Cathedral, London was adventurous but, with support from Autodesk added to my own experience, I felt confident that the project would benefit."

Despite the challenge, Arup was able to issue a first draft of the structural design in a matter of eight to nine weeks – so meeting the schedule.

## Big decision

One of the biggest names in the construction industry – Arup is a global firm of designers, engineers, planners and business consultants providing a diverse range of professional services to clients around the world. With almost 9,000 staff working in 82 offices in more than 34 countries, it exerts significant influence on the built environment and is regarded as a prominent creative force behind many of the world's most innovative and sustainable designs.

With such credentials, Arup is inevitably one of the first firms to find out about and trial new software solutions and Revit Structure was no exception. "The launch of Revit Structure was eagerly awaited and I was keen to try it out," says Williams

Like many in the structural design community, Williams is accustomed to using a complete variety of software in his day to day work. "In 2005 Arup made the decision that it would deliver the design of every building in 3D wherever possible," he explains.

"We've been using a variety of 3D solutions, but could immediately see the advantages an Autodesk solution would bring – not least because of its parametric change technology."

He says that he didn't take the decision to use Revit Structure on such a large project lightly. "However it needed to be designed in 3D and Revit Structure seemed the best choice. We knew we had the support of Excitech (the Autodesk reseller partner) and after sitting down with them and discussing how we would do it, decided to go ahead."

The project in question was the structural design of One New Change, a seven-storey, mixed office and retail redevelopment and building on an island site bounded by Cheapside, New Change, Bread Street and Watling Street in the City of London – close to one million square feet gross area. The architectural design, by Ateliers Jean Nouvel, had been heavily influenced by the building's prestigious position right opposite St Paul's Cathedral.



***One New Change is a mixed construction building situated directly opposite St Paul's Cathedral, London. Image courtesy of Land Securities.***

"Obviously, the architects' design was entirely governed by the scale of the cathedral and the need to provide as clear a view of it as possible. This meant the design has some particular features such as inclined columns sloping backwards and cranked beams in the roof area."

The architectural drawings were transferred as DWG files. "We imported them as data into Revit Structure and used this as background to build up our model," Williams explains.

"For me, the main benefit of using Revit Structure is that it enables me to manage everything in one single software solution. You can change your levels in any particular view and you know that everything else will change to accommodate this.

"You can shift or amend a structural element in elevation or section and know it has automatically updated on the plan. There are other related benefits too. You can manipulate sections knowing that they will take on an updated drawing number according to where you've dropped them in on the sheets.

"As you go through your customary checking procedures you are delighted and reassured when you discover that all your changes have been co-ordinated. This has proved to be a massive advantage for me.

With other software, changes are a two-stage process. If you change the 2D view, you then have to go back and update the 3D model. This is really time-consuming and opens up many opportunities for error.

However, Williams says that, "Revit Structure relieves the nightmare of having to make an alteration at the eleventh hour and having to work through the night to co-ordinate the model, drawings and documents".

"Or often you may see a way to enhance the design at the last minute. Previously, if you were working against the clock you may have had to let it go as the change would take too long. Now it's less of a problem."

As well as enabling the development of a physical model of a structural design, Revit Structure also offers bi-directional linking to analysis software. As Williams explains, this capability wasn't put to the test on this particular project. However, Arup has a bi-directional link to Revit Structure with its in-house GSA analysis application.

"This is currently being tested – and the results are good," he reports. "This will mean the analysis results will automatically update the design and documentation everywhere, so increasing efficiency, improving accuracy and streamlining co-ordination."

Williams is the first to admit that they still have a lot to learn. "We've been using AutoCAD for almost 20 years and Revit Structure for a few months, so obviously it's still early days. We've had fantastic, round-the-clock support and expert guidance from Excitech which has helped immensely.

"But the signs are very good and we are excited about learning more about Revit Structure's capability."

***www.autodesk.co.uk/revitstructure***

# Structural synergy

With the help of Bentley's RAM Structural System integrated design and analysis tools, KNA Consulting Engineers was able to accelerate the development of a Californian high-school building project.

Since its incorporation as a US city in 1991, Murrieta has become one of the fastest growing communities in Southern California. In fact, Murrieta has more than doubled in population from 2000 to 2006, growing from just under 45,000 to nearly 100,000 residents in just seven years.

Its climate, quality of life, and proximity to San Diego are some of the reasons why families have chosen it to raise their children within view of the Santa Rosa Mountains. But the community's rapid growth has put a strain on Murrieta's school system, especially its high schools.

As an example, enrolment for the 2007-2008 school year at Murrieta Valley High School was just above 3,000 students while Vista Murrieta High School breached 3,500 students. To address the city's growing student population, the Board of Education signed off on a new high school for the city with capacity for up to 2,200 students, approving the schematic design in November 2005.

When final design was approved in April 2006, a ceremonial groundbreaking was held in March 2007 for Murrieta Mesa High School, a $104 million facility located on 62 acres. The 249,000-square-foot campus will include 82 classrooms, a performing arts centre, and adjacent athletic facilities that feature a stadium for football, American football, and track and field; a pool complex; baseball and softball fields; and tennis, basketball, sand volleyball, and handball courts.

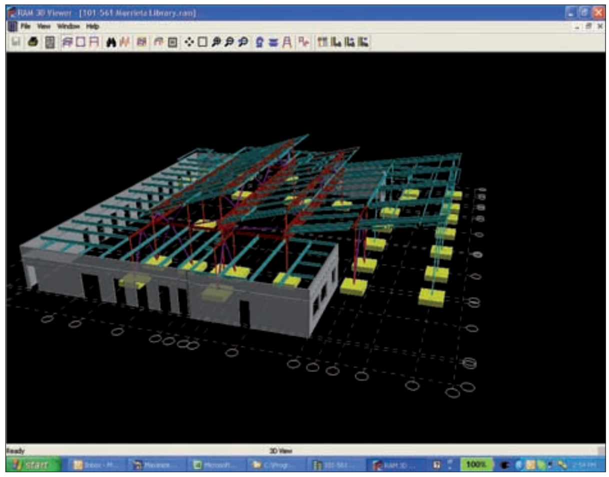
Because Murrieta Valley and Vista Murrieta were reaching their maximum capacities, the need to have the new school constructed as quickly as possible was of paramount importance. To meet the Murrieta Valley Unified School District's goal, the design team placed design and construction of Murrieta Mesa High School on fast-track development.

Design development began in December 2005, and in November 2006 construction documents were submitted to the State of California's Division of the State Architect for approval. Grading of the site - the top of a mesa located between the I-15 and I-215 interstates - began in February 2007 and building construction started in August 2007. The school is scheduled to open in August 2009.

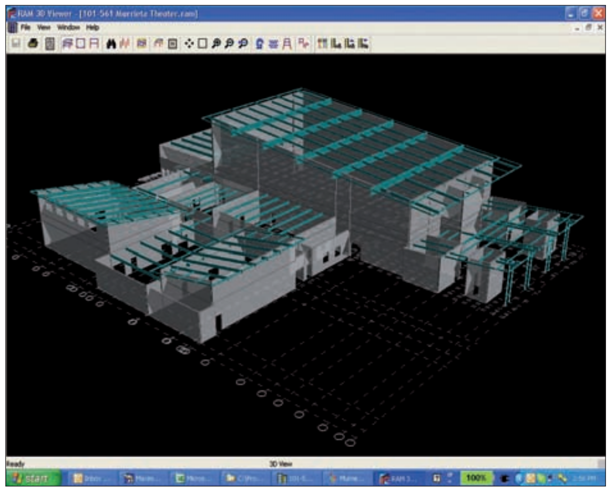
For the structural engineers at KNA Consulting Engineers, the accelerated design schedule was the least of their challenges. More pressing was incorporating diverse structural systems such as masonry shear walls, steel-braced frames, and cantilevered column structures into the design.

Additionally, a seismic fault on the site of the Murrieta Mesa High School required the designers to pay close attention to how the buildings would perform during an earthquake. The project's architectural requirements also called for a broad range of materials, including concrete, masonry, and steel. KNA handled these challenges by deploying Bentley's RAM Structural System solutions, which included RAM Steel, RAM Frame and RAM Foundation.

"Bentley's RAM structural engineering solutions were able to handle complex lateral systems and a mixture of materials," said Josh Randall, a principal at KNA. "Support and training was also a factor in choosing Bentley products. RAM has always provided superior customer support and the available RAM



*RAM Structural model of Murrieta Mesa High School Library.*



*RAM Structural model of Murrieta Mesa High School Theatre*




*KNA Consulting Engineers designed Murrieta Mesa High School, a new $104 million high school in Murrieta, California.*

training allowed us to make better use of the products we already had."

## Streamlined process

RAM products work together to allow users to choose the modules and products that best suit their needs, Randall said. Data generated in one product is easily transferred to others, and the DXF export capabilities enabled creation of design documents that were completely coordinated with structural calculations.

To design the structural system, the design team started with basic gravity framing models, which were created during the design development phase of the project using the RAM Structural System, Bentley's analysis and design program specifically for buildings. The team was then able to generate complete gravity, lateral, and foundation designs through integration of RAM Steel, RAM Frame, and RAM Foundation within the RAM Structural System program.

The tight integration enabled KNA to streamline its design process and provide a higher level of coordination between the gravity and lateral models. Because these three RAM modules operate from a single model, the integration of the gravity, lateral, and foundation programs reduced the number of files and printed calculations KNA had to provide to the enforcement agency.

In addition, KNA used RAM Connection to design the seismic brace connections and drag connections. RAM Connection can be completely integrated with the RAM Structural System for integrated connection design. KNA then imported the building model, including gravity and lateral loads from the RAM Structural System, into RAM Advanse, Bentley's structural tool set program, to complete the masonry shear wall design. RAM Advanse is frequently used by structural engineering firms to analyse masonry walls, design tilt-up walls, retaining walls, and concrete shear walls.

"The integrated RAM solutions allowed us to develop design documents that completely coordinated with the calculations in a time frame that would have previously been unheard of," said Randall. "We were also able to focus CAD staff on other areas of the drawings, which in the end produced a set of documents superior to what the firm could have produced without the products."

KNA had some experience with the RAM Structural System, as it had previously used the analysis and design capabilities of this program and its DXF export function to create structural floor and roof framing plans. To handle the structural engineering for Murrieta Mesa High School, however, KNA planned to take even greater advantage of RAM structural tools and their DXF export capabilities.

By taking part in a two-day training session on RAM Frame, the lateral analysis and design program, team members took full advantage of the program capabilities and became more confident in their lateral designs. RAM Frame performs additional special seismic code design and detailing checks for members and joints, based on AISC 341–05, AISC 1997–LRFD, UBC 1997–LRFD, or UBC 1997–ASD. (Bentley's RAM software suite also supports the full range of British design codes including BS5950:2000 for steel design, BS 8110:1997 for concrete design, BS 6399 for Wind and Imposed loads, and SCI Publication P354 for floor vibration analysis – Ed). In addition, the team added RAM Foundation to complete an integrated foundation analysis and design and to create foundation plans as easily as floor and roof plans.

***Located on a 62-acre site, the 249,000-square-foot campus will house 82 classrooms and up to 2,200 students.***





By eliminating the need to mark up plans and have them drafted, KNA not only cut down on production time, but also on quality assurance time. There is no longer any need to verify coordination between the structural model and the drawings. The ability to export DXF files from the RAM products allowed the four-person structural design team to take the construction documents from design development to a suitable level for submitting to California's Division of the State Architect in just four weeks.

By implementing Bentley's RAM Structural System solutions to incorporate the diverse structural systems of Murrieta Mesa High School, KNA estimates that it saved between four and six weeks on the structural design process. It also recouped its investment of two days of RAM Frame training and the purchase of additional RAM software on this project alone.

"RAM's software and training allowed us to not only meet challenging deadlines, but to do so with unparalleled levels of coordination and accuracy," Randall concluded. "The on-time delivery of the project documents reflected a greater level of completion than what would have been possible without RAM products. The return on investment is reflected in the time savings."

***www.bentleyswinningtem.com***

### Repeat performances

In addition to the software solutions used on the Murrieta Mesa High School, KNA uses other Bentley structural software solutions on other projects in its portfolio. These include:

- RAM Steel to design composite and non-composite steel beams, columns, and baseplates.
- RAM Frame to perform static and dynamic lateral finite-element analysis of building systems, including frames and walls, supporting steel, concrete, and masonry, alone or in combination, and automatically compute all building code lateral design loads for wind and seismic forces.
- RAM Foundation for analysis, design, and drawing of spread, continuous, and pile cap foundations.
- RAM Advanse to provide 2D or 3D finite-element modelling, design, and analysis, which supports numerous design codes for wood, steel, concrete, and cold-formed steel and features analysis capabilities that include dynamic analysis, second order analysis, tension and compression-only members, and thermal loads.
- RAM SBeam designs for single composite and non-composite steel beams.
- RAM Connection to provide solutions for connection types such as beam-to-column flange, beam-to-column Web, beam-to-girder, beam-to-beam, column splices, beam splices, column-beam-brace gusset connections, Chevron brace connections, X brace connections, and brackets.

# Tekla at Kingspan Off-Site

Kingspan Off Site made the move to Tekla Structures to assist in the design and engineering of its systems, which in turn directly drive its manufacturing process.

### What is Tekla Structures?

Tekla Structures is a versatile 3D modelling and detailing solution that integrates the entire project workflow from sales and bidding to detailing, fabrication and erection, no matter what the material. Tightly integrated functions provide more opportunities for collaboration and open interfaces ensure for a smooth transfer of information. Tekla Structures provides enhanced potential of interaction and collaboration between customers, designers and other parties within the construction environment.

Kingspan Off-Site – Profiles & Sections located in West Midlands is a subsidiary company of the Kingspan Group. The business has been providing steel manufacturing solutions to the UK and European markets for over 20 years. Kingspan Off-Site is firmly established as a manufacturer of light gauge frame construction systems and has recently grown into a high volume manufacturer in advanced modern methods of construction utilising high levels of on and off-site manufacture (OSM) technology.

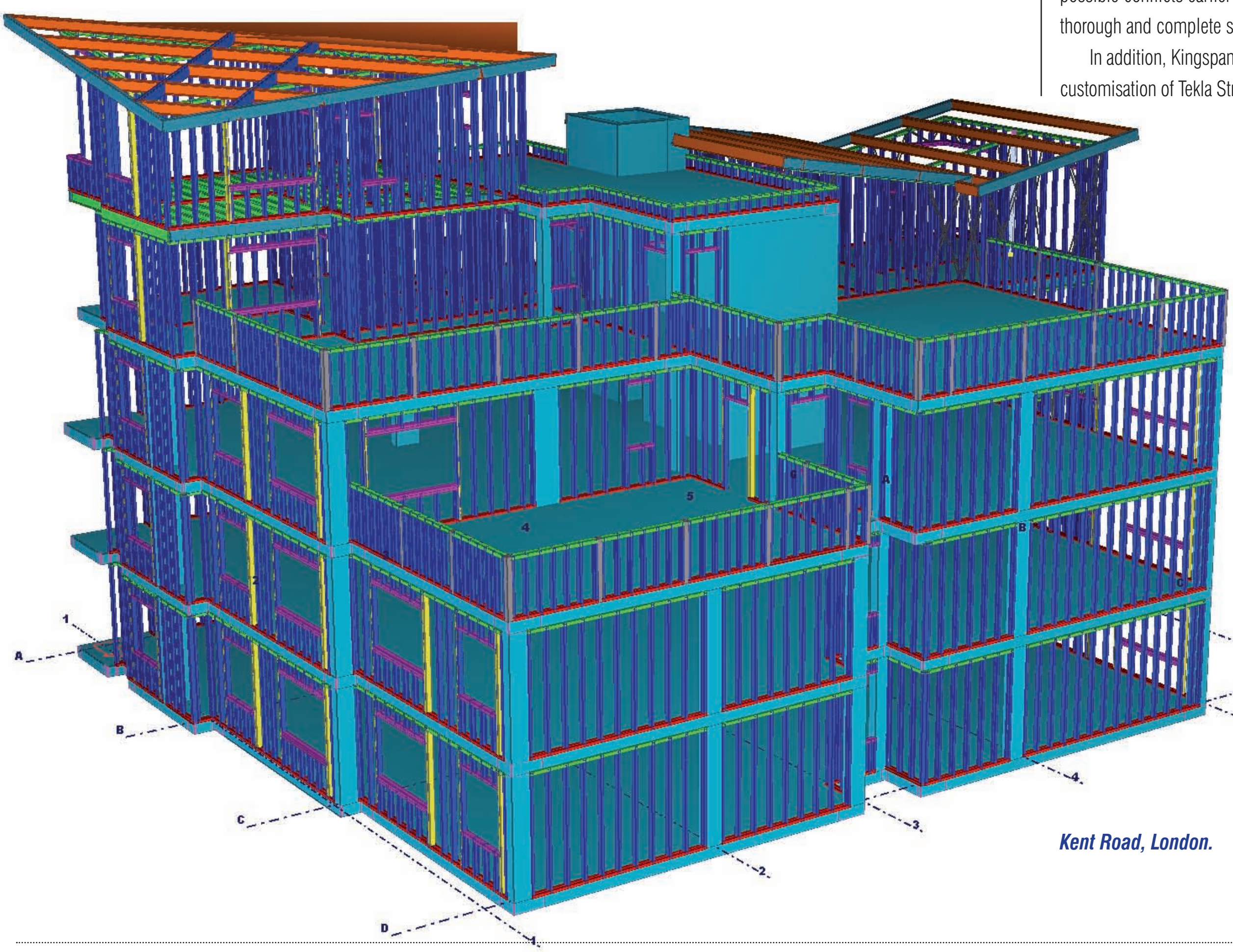
Kingspan Off-Site has initiated a strategic project to implement 3D modelling capabilities and to integrate the design and manufacturing facilities within the company. Tharinda Rathnapala is a 3D modelling researcher for Kingspan Off-Site. Although his initial degree speciality is Automotive Engineering Design, he was recruited to help optimise the company's design and production processes.

Tharinda has been with Kingspan Off-Site for 1.5 years – about the same time the company started to use Tekla Structures. Kingspan Off-Site employs ten detailers, and currently holds a number of Tekla Structures licences. Tharinda explains the choice of Tekla Structures, "Tekla has the leading presence in the UK construction industry," he says. "The market reputation and usage within a number of leading steel detailing companies around the world solidified Tekla Structures as our primary choice of 3D modelling software".

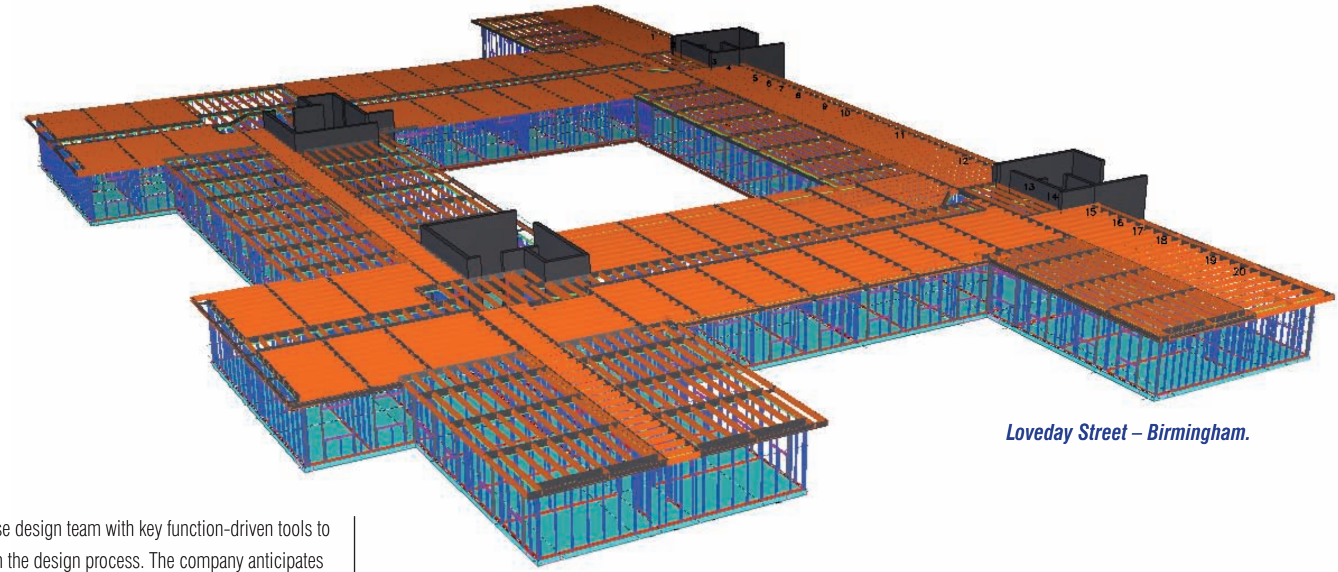
Kingspan made the move to Tekla Structures to assist in the design and engineering of its systems, which in turn directly drive its manufacturing process. Initial assessments have proven very positive in the use of Tekla Structures in complex live projects.

The latest 3D environment helps the designers to detect any possible issues within the given construction project and clarify those issues prior to site installation. The clear advantage is increased efficiency in the design phase, which ultimately results in minimised product cost and a shorter delivery period to customers. Kingspan Off-Site is able to receive 2D or 3D CAD information from a number of different CAD packages. This allows the Design Team to quickly assimilate 2D information from a third party in to an intuitive and intelligent 3D environment. This makes the review of geometric data faster, highlights possible conflicts earlier and means the 3D model is a thorough and complete set of information.

In addition, Kingspan Off-Site has developed total customisation of Tekla Structures software to provide its




*Kent Road, London.*



*Loveday Street – Birmingham.*

in-house design team with key function-driven tools to quicken the design process. The company anticipates further time reduction in planning and manufacturing procedures due to specialised CNC coding.

The company's Kenton Road project is a successful example of a load bearing project completed within a 3D environment. This residential development consisted of a two storey load bearing structure with a complicated duo-pitched roof above three storeys of infill framing.

Project Design Manager Peter Jones states, "Using a 3D environment was useful to solve issues with complex light gauge steel roof structures within the project. Tekla Structures reduced the time required in processing drawings whilst maintaining our high standards. The parametric features available contributed heavily to bring the project design stage to conclusion in a record time."

Technical Design Manager David Yates adds, "Having the ability to investigate the model in a 3D environment was a key element to solve onsite issues and design complications raised during the project, helping remove the project design stage from the critical path."

## Interoperability

One of the most significant innovations in Tekla Structures is the open application programming interface (Open API), which makes it possible to tie together the different design applications and disciplines into a common 3D product building information model.

Open API facilitates the integration of different design applications, such as analysis and design software into the modelling environment. The Open API also makes it possible to develop additional functionality into the Tekla Structures platform. The Tekla Structures Open API is implemented using Microsoft .NET technology.

Kingspan Off-Site currently uses the .NET API to retrieve information from a given model. The system without doubt provides more benefits for the Kingspan Off-Site design and manufacturing process. The company has also looked into using the Tekla web publishing facility to provide 3D information to clients and sees this function as a positive impact on service in the future.

## Tekla support

Kingspan Off-Site has found the customer service and technical help extremely approachable. Tekla is committed to customer support and helps all new users get started as well as maintain development. Tekla also heavily invests in R&D. This means that each new software version makes a substantial difference in day-to-day productivity, allowing the user to focus on design while managing other valuable assets: data and information.

With regards to future technical developments, Tharinda states that "training is a key aspect to implementation. As Kingspan Off-Site begins to get more experienced Tekla Structures users, the number of licences will in turn increase." He continues, "We intend to roll-out all projects in the future with Tekla Structures. This means we will use Tekla Structures for all sectors equally. At the end of the day, this not only creates a more efficient process for our other services but also maximises our level of ability to serve our customers more effectively. Overall, a winning situation."

***www.kingspanoffsite.com***
***www.tekla.com***

## Development opportunities

Kingspan Off-Site has strengthened existing links with regional universities and government technology programmes by setting up a Knowledge Transfer Partnership. One such collaboration is with the University of Wolverhampton. Both the university and Kingspan Off-Site have introduced curriculum to increase the undergraduate knowledge/experience with 3D modelling packages in regards to the built environment. This should deliver a positive impact on the future job market - the increased skills in the latest technology will then be available to the UK construction industry.

Kingspan Off-Site strongly believes in the continuous development of new systems and technology to deliver sustainable and affordable constructions. Tharinda Rathnapala joined Kingspan Off-Site as a KTP Associate to investigate and deliver a 3D modelling system within the Design Department and disperse knowledge throughout the business by developing design to production processes that increase manufacturing simplicity and productivity.

Tharinda's brief also includes the development of virtual reality simulations and animations communicating best practice construction techniques for Kingspan Off-Site Construction Systems. This type of user interface will lead to a reduction in problems on site through increased visual communication, something that can't always be achieved in a conventional 2D working plane.

The use of 3D modelling yields many benefits, the most significant advantage being the ability to rapidly model buildings and generate intuitive drawings that will help material scheduling and automotive manufacturing.



# Project showcase: Al Kazim Towers

This 'fast track' 22 month contract for the construction and completion of the 52-storey twin towers, part of the Mohammed Amin Al Kazim project in Dubai, was detailed by Gulf Steel Industries in less than three months using the StruCad 3D modelling system from AceCad Software.

The Al Kazim towers project which has recently celebrated its 'top out' (Week 52) features three basement levels, a ground floor and an eight storey podium plus two 52-storey towers rising 44 floors above the podium to a height of 203m. Rising above the towers are two aesthetically-designed roofs 'topped out' at 265m. These iconic towers will include residential, office and commercial space and stand in a very strategic area near the fifth interchange on Dubai's Sheikh Zayed road. With parking for almost 2,500 cars on the basement and podium levels, the towers are built on a massive land scale catering to the needs of the business community of Dubai Internet and Media Cities.

The spectacular roof structure of each tower consists of approximately 1,200 tons of steelwork formed into intricate arches to echo the lines of the world famous Chrysler Building in New York. The design was modelled entirely on StruCad and according to Head of Engineering for Gulf Steel Industries, Mr KG Surendran, 'enabled the project to be delivered in less time than anticipated and with accuracy to meet and exceed the client's requirements'. As a result of the collaborative nature of StruCad, links with analysis and design packages such as Staad Pro were simply facilitated. The StruCad database enables the bi-directional transfer of design data streamlining the engineering, design and detailing functions, whilst fabrication data is automatically generated by the system. ***www.acecad.co.uk***

**Architect - National Engineering Bureau**
**Main Contractor - Al Shafar General Contracting Co**
**Contractor - econstruct**
**Contractor - Gulf Steel Industries**



# Lynn Allen interview

At last year's AUGI Design Academy in Birmingham, AEC Consulting Editor, **John Marchant** caught up with Lynn Allen, worldwide Autodesk Technical Evangelist

Since the introduction of the 2007 release, AutoCAD has featured enhanced capabilities for working in 3D. I asked Lynn Allen if these new capabilities have seen an increased uptake of 3D.

"I would probably say it helped some. Anything that makes it easier for people to get their jobs done regardless of the program makes me a happy person. You still have a lot of people who love AutoCAD, who are focussed on the 2D aspects and who don't want to leave AutoCAD, though they may dabble in 3D occasionally. The 3D in AutoCAD 2007 was much more user friendly compared with previously. Using 3D on AutoCAD is a good step for them and I certainly think more people have been willing to give it a try."

She notes, "I am still of the mindset that if people are ready to make the move to 3D, they will make the move. I think we can do all of these things to try to make it easier for them but I still believe there is usually some catalyst that occurs - either they lost an account to a competitor who is using say Inventor - and begrudgingly people often are forced to 3D . However, once people do it, they think 'why didn't I do it sooner'. I think AutoCAD is a good place to start, though if they truly want to work fully in 3D they should go to Inventor or Revit, for example."

Looking at the attendees at the AUGI Design Academy, I formed the view that almost all attendees were AutoCAD users. Did Lynn agree? "I didn't get that feeling at the lunch time session," she said. "I was impressed at how many hands went up when asked who were Inventor users, or Revit users. Maybe they needed a good meal first!!" She added, "At these events there tend to be more AutoCAD users than anything, then LT, and I would say a big chunk of Revit or Architectural Desktop users, then Inventor." Lynn also pointed out, if you come to a conference like this, you'll find Inventor classes and Revit classes, which they would not have if there was no demand."

Inventor LT is a cut down version of Inventor, for part modelling only, and is currently available free of charge but only to those in the US and Canada though it is expected to eventually sell for $1,000 or so. You'd have thought that Autodesk would have paid more attention to its customers outside the US, given that Autodesk earns something like 60% of its $ 1.8 billion revenues outside America. This is a missed opportunity in my opinion. Be that as it may, what does Lynn think about the product? She responds, "I love the fact that it gives people the chance to try the product and see if they like it before they spend the money on it. I am a huge fan of that. I like the fact that it opens the door for teenagers, college students, for the guy who wants to work at home. It opens a lot of doors."

The levels of Autodesk vertical products are always of interest to commentators. Out of Autodesk's $1.8 billion annual revenue, 44% is earned from the sale of AutoCAD, AutoCAD LT and other platform products, 18% from MCAD, 13% from architecture and construction products, 12% from infrastructure products and 13% from media and entertainment. Thus some 56% of revenue is now earned from 'vertical' products. Lynn again, " That's good. Not too long ago, AutoCAD was bigger than all the verticals put together. People still love AutoCAD and it is still strong especially in Asia." Robert Green in his CAD Manager's Survey 2007 notes that people are not jumping off the ship to 3D with only 6% of users working fully in 3D. How does Lynn feel about that? "It's a gradual process," she says, "and I totally believe that. As I said earlier, people will go when they are ready. Right now, people are trying it – looking at it – some people have jumped in with both feet – but I thought his numbers were good. It was interesting how people were not running the 3D as fast as they thought they would – but they are moving that way." She qualifies this by saying, "It's a no brainer in manufacturing – they know that is the way it has to go. Architects have a different mindset altogether. They just think differently and we need to work with them differently. We need to help them through the whole process rather than just selling it to them."

Autodesk has a history of acquiring other companies and other technologies – Micro Engineering Solutions, Woodbourne, Genius, Softdesk, Alias and now NavisWorks. That must leave a legacy of various user interfaces. Lynn comments, "Autodesk is aware that our software does not all look the same. We really want our users to feel comfortable when they move from one product to the next, though we don't want to take away from the existing software, we don't want to take away from the people who are comfortable with it the way it is. Marc Goldwin's job is to make sure that everything works together and has the same 'look and feel'. You should talk to him."

***www.autodesk.co.uk***



*Lynn Allen of Autodesk.*



# On the map

Ordnance Survey's Print Services is benefiting from the latest print technology from HP to deliver excellent photographic quality for aerial photographs, crisp line drawings and smooth area fills with subtle tones.

Ordnance Survey has been providing accurate, reliable and detailed geographic information for more than 200 years. As Great Britain's national mapping agency, it provides the most accurate and up-to-date geographic data from complex digital information to traditional walking maps for Great Britain, relied on by government, business and the public.

Ordnance Survey offers a complete mapping process from flying over the country taking aerial photography, to shipping of the final, printed products through Ordnance Survey Print Services. Its modern and extensive in-plant facility at its headquarters in Southampton, allows Ordnance Survey Print Services to provide its clients with a one-source total solution.

Ordnance Survey originally invested in a HP DesignJet 5500 Printer from City and West End Solutions to play a critical role at Print Services, producing large-format proofs for production printing of maps on offset machines. The inkjet printer was used to print the map covers themselves on cardboard, printed 8 up on a carrier, showing a picture of the area covered by the map, and with a surrounding silver spot colour. The HP DesignJet 5500 was also extensively used for advertising material, from small A2 posters up to billboard, large wall displays for trade shows and for shorter print runs on resistant media for specific products, such as maps used in the field.

Although overall performance of the HP DesignJet 5500 Printer was satisfactory, when HP introduced the HP DesignJet Z6100 Printer, Ordnance Survey was eager to assess its impact on their map printing business.

Garry Heaton, Prepress Technical Business Officer at Ordnance Survey, describes how the new printer was an instant success. "The most obvious improvement using the new DesignJet Z6100 Printer is the speed of the machine. It's much faster than the DesignJet 5500, and the quality is much better. The fast printing takes the sweat off coming up to deadlines for trade-show displays and other publicity material production."

## Stand out image quality

Image quality is the critical area for map printing businesses. Printed images present a series of unique challenges, demanding range, clarity and precision for data-intensive mapping applications combined with photographic quality for aerial photographs, crisp line drawings and smooth area fills with subtle tones that can make all the difference.

Garry was delighted with the results from the new printer. "The outstanding print quality from the DesignJet Z6100 is a selling point for the map. There are people out there that buy maps because they just love maps. When the maps look that much better, our customers are that much happier." The difference is marked he adds. "We have a series of touring maps where we highlight areas of Britain that are of a great interest to tourists. We put hill shadings on these, but on the DesignJet 5500 the shading didn't stand out very well. On the DesignJet Z6100 we've noticed a marked difference. Shading is much clearer and crisper. The image quality has improved immensely."

Thanks to original HP Vivera pigment inks, with the HP Three-black ink set (matte black, photo black, and light grey), the HP DesignJet Z6100 achieves millions of colour combinations across a wide colour gamut and across a wide range of media, producing a broad range of blacks and grey with smooth, subtle transitions, true grey neutrality, and rich black density. Garry claims the image quality compared to the old printer has greatly improved. "For a trade show we laid lots of display images out on a black background, and on the DesignJet Z6100 we got much more depth of colour, a denser black, and much more vivid colours than on the DesignJet 5500."

## Printed to last in the field

Original HP Vivera pigment inks deliver an unmatched combination of outstanding photo-image quality, water resistance, and exceptional fade resistance for over 200 years (for interior displays away from direct sunlight). The HP DesignJet Z6100 Printer inks also dry much quicker than on the old printer. The improved resistance and shorter drying times also help avoid damaging prints from handling and accelerate finishing processes. In combination with the new HP Vivera pigment ink durability, Garry says this is a major time-saver and allows them to produce maps that can be used in the field. "Prints on plastic-like material from the Designjet 5500 would take quite a while to dry. On the DesignJet Z6100, it's a lot quicker." He adds, "Changing from dye-based inks to UV inks on the DesignJet 5500 was a bit time consuming, but with the DesignJet Z6100 a job comes in for display purposes and there's no problem. With just one ink set for everything all prints are long-lasting so we just go straight ahead and print the job."

Garry is also extremely satisfied that colour accuracy and consistency are no longer a trial and error process with the HP Designjet Z6100 Printer, saving time and eliminating waste. "Using the DesignJet 5500, we had to alter colour profiles a number of times before we got a print that was not oversaturated in the dark areas - we were wasting time and material there. On the new DesignJet Z6100 the ink density and colours are fantastic first time off. It's perfect from the word go." Their confidence in the reliability and colour accuracy has never been higher. "Every map is folded and contained in an individual cardboard cover with a picture of the area concerned surrounded by a spot colour, silver. The DesignJet Z6100 gives us the outstanding image quality we are looking for, with accurate colours straight off."





## Maximising resources

Saving time, maximizing efficiency and minimizing waste are recurring themes for Ordnance Survey Print Services, and according to Garry Heaton the HP Designjet Z6100 Printer optimises productivity and resource utilisation in every area. "Our Designjet Z6100 is going all day, every day. We haven't had to change a cartridge yet. They're much larger and the ink usage is a lot more efficient than on the DesignJet 5500." The large-capacity ink cartridges combined with long HP rolls, give Ordnance Survey added confidence in trouble-free overnight printing runs.

"We were printing old mapping, 150 or 200 years old, originally hand drawn, covering the country. The DesignJet Z6100 had a long roll of paper loaded, so we left it to print overnight. The maps looked stunning when we came in the morning."

The outstanding quality and range of media designed with the HP Original Vivera pigment inks, give Ordnance Survey greater peace of mind to explore innovative GIS printing applications. "The DesignJet Z6100 has opened up the possibility for us to experiment with different material while always getting accurate colours. We produced a series of 40 aerial photographs on photo paper along with corresponding drawn maps on transparent paper. The drawings sat over the photos to highlight changes on the ground. Our customers were very pleased. It was probably the first time they'd had something like that done," confirms Garry.

## Expressing professionalism

The HP Designjet Z6100 Printer has truly transformed GIS printing capabilities at Ordnance Survey Print Services, allowing them to work more effectively with increased confidence, improving their productivity and streamlining their workflow. Garry concludes, "Job turnaround with the DesignJet Z6100 is much faster compared to our previous printer, giving us more confidence on tight product schedules. Our workflow is now quicker and simpler, and there is no trial and error. The printer efficiency is impressive, saving us time and materials." ***www.cwesolutions.co.uk***

# HP workstation interview

At the tail end of last year HP held its annual Quad Fest event to launch its new workstation family. **Greg Corke** caught up with HP's Director of personal workstation marketing, Jeff Wood, to get the low down on Quad Core, AMD Opteron, Vista and green workstations.

**Greg Corke:** The core f HP's workstation family is focused on Intel but you've recently introduced an Opteron machine with a very low price point. Can you tell me a little about that workstation?
**Jeff Wood:** Last September we introduced the xw4550, a low-end Opteron, single socket system. The xw4550 actually has an integrated 2D graphics controller. So for those folks doing rudimentary 2D and maybe some 3D design it will be fine with that particular graphics solution without having to add discrete graphics.

**GC:** Is the controller certified?
**JW:** Yes, if you thinking more about the DX-based solutions – AutoCAD (2D), Inventor or even Revit. From that perspective we're going to see a lot of folks pick it up?

**GC:** And why Opteron at the low end?
**JW:** Just from a cost perspective - getting a lower-end price point. The integrated graphics is a thing that Intel doesn't have from an architecture perspective at the moment. This was the first workstation starting under $800 and that was the price point we were really trying to hit.

**GC:** But isn't AMD's Athlon even more cost effective?
**JW:** No it's pretty much the same cost envelope there. The Opteron 1000 is highly leveraged from Athlon64.

**GC:** So in addition to AutoCAD users are you targeting specific geographies with the xw4550, say India and China?
**JW:** Yes emerging countries for sure, hitting the lower end cost point.

**GC:** You also have Opteron at the high-end. With the new Intel chips performing so well where does this leave the xw9400?
**JW:** The xw9400 was, by design, built to run the new AMD Quad Core 'Barcelona' chip. We've been holding our breath for AMD and we think it will probably be February we will be in production.

**GC:** And how do you think the performance will perform compare to the Intel boxes?
**JW:** It's going to be very application dependent, so for those folks that require accessing a lot of memory, frequently, they'll see a benefit over the Intel architecture, primarily because of the integrated memory processing on board the CPU itself, whereas, by design, with Intel's front side bus architecture there is more latency accessing memory. So some of the oil and gas guys, some of the high-end 3D animators using big data, CAE, for example, folks doing analysis with big big models are going to see a benefit for Barcelona, but for more mainstream applications we believe Intel will still have the performance leap.



*Jeff Wood, HP's Director of personal workstation marketing.*

**GC:** And what about Operating Sytems? At the moment you're pushing Vista, but HP is offering a downgrade to XP. Is that more of a marketing thing?
**JW:** You know, Microsoft in the beginning had developed a plan that they were going to discontinue XP by January 2008 and we could no longer ship XP. Looking at the very slow adoption of Vista by our customer base we worked with Microsoft and said this isn't going to work and even through 2008 we need to continue to ship XP. From a branding perspective, they still wanted to promote Vista, so we uniquely developed this plan to do this Vista downgrade, which was the best of both worlds for us. It allowed the end customer to have a Vista license and the media to upgrade when ready, but we could still pre-enable Windows XP on the hard drive and ship it out the door. So we felt both of us had a win because they got to market Vista and we got to deliver XP. But for the customer, if you think about it, they have no way to get to Vista other than buying it without this opportunity. Quite honestly most folks will wait for Service Pack 1. All of our Enterprise customers are testing it, making sure their applications are compatible, all their peripherals (drivers) are compatible and I think you'll see a big move in the second half of 2008. It's a phenomenal Operating System - the visual interface is just incredible. It just has a lot to do with application availability and performance, and we're all counting on Service Pack 1.





**GC:** So you think Service Pack 1 will improve performance?
**JW:** Absolutely, we're working very specifically with Microsoft and the software vendors to uncover where the performance issues are. We're working with Nvidia and ATI from the graphics performance perspective. As typical we, at HP, will effectively enable the market to move there because we do have the engineering expertise to work with these folks and optimize for these environments.

**GC:** Do you think the ISVs are doing enough to make Quad Core a success?
**JW:** As much as they can. In our friends with the enterprise CAD solutions - Dassault, PTC, UGS, there's not a lot they can do. Architecturally, from a software perspective, it's just the way the applications have been built for years and years and years, it just does not lend itself well to threading. PTC tried to do a few different tools that were threaded several years ago and didn't see a lot of value in it at the time. So truly the advantage for the designer is the ability to do other things simultaneously. We're finding that the automotive guys, instead of designing a particular part and sending it off to the server as a batch job for analysis and waiting a few days for it to come back, they're designing two or three different versions of the part, sending it off for analysis in the background, continuing to work, and getting immediate response. So it's optimising their performance. Now the next thing will be to move to a 64-bit environment and build more assemblies versus components and do the same thing.

I continue to see an insatiable demand for performance, even in a multi application environment, Compared to Boeing when they designed the 777, the first digitally designed airplane ever, and they still had challenges because the hardware and software just wasn't there. But now they can render a fully loaded 777 model in real time.

**GC:** What other barriers do you think there are to adoption of Quad Core technology?
**JW:** It's been price. And, quite frankly, Intel has collapsed their Quad Core pricing on top of their Dual Core. So specifically for this next product introduction it will be the first time we have a full line up of Quad Core processors from top to bottom at very similar price points to where we were at with Dual Core just last year. So honestly I think that's probably the last barrier to success, because the software guys have

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really worked forever because there have been dual processor capable machines for a long, long time.

**GC:** But with Dual Core you can still get higher clock speed, which is most important for most CAD users?

**JW:** You do, you still will.

**GC:** But isn't that always going to be a barrier?

**JW:** I don't know….. stay tuned for Quad Fest 3 (laughing). Because next year is a different story.

**GC:** Producing 'green' workstations seems to be a very important issue for HP at the moment. Can you take me through what you have done for the new products?

**JW:** There are three aspects to how we are driving for the environment. In terms of energy efficiency, what we've done across the whole portfolio is move standard to what is called an 80plus power supply, meaning the power at the plug translated to the system itself, we will be at least 80 percent efficient in our translation. Before there was no real benchmark and we may have been anywhere from 50 to 60 percent efficient, so you get a lot of power loss and of course that power loss is in the form of heat. So, for us, moving to the more power efficient solution, now you're taking less power at the plug, it will be less costly to run our workstations. So far we look like the only workstation vendor in the industry to have adopted that strategy and in fact you can imagine with this class of power efficient power supply it's in very low volume right now, because it's really for the workstation market and not full blown desktop PCs, so it's at a higher cost to us. But we've not passed that cost onto the customer, keeping our prices very stable. So it's a benefit and a good differentiator for our workstations.

With that, we are also very focused on product re-use and recycling from a green environment perspective, even from a delivery perspective. All of our cartons that we deliver our workstations in are made from post consumer recycled materials. We have taken out all of the literature and documentation out of our delivery systems and put everything online or in CD form, you can order the CDs. Because typically if we deploy 500 seats in an enterprise account they've got 500 copies of these things that they throw away because the IT department are managing them and they know more about them that we do. There's a great opportunity there.

The substances and materials – last year the big buzz word was RoHS (Reduction of Hazardous Substances). We were the first workstation vendor to deliver that. In fact we updated our current shipping products to be RoHS compatible, where our competitors did not and they forced their customers to buy the new products versus the old. And in fact we won a lot of business away from Dell and others because they didn't do that and it was very important to a lot of key accounts.

So that along with the new EPEAT (www.epeat.net) standards that are going industry wide, we have silver certification right now and, fingers crossed, by the end of the year (2007), we'll actually have gold status and we expect to be the first workstation vendor to do this.

All of our new systems also have Energy Star 4.0 (www.energystar.gov) compatibility. The entry workstation, the xw4550 is completely Energy Star compliant for all configurations and as you move up the line it's a little bit harder to meet all the standards. When you've got dual graphics and 64GB RAM you're just not going to be Energy Star compliant but we work very hard to offer many configurations that are.

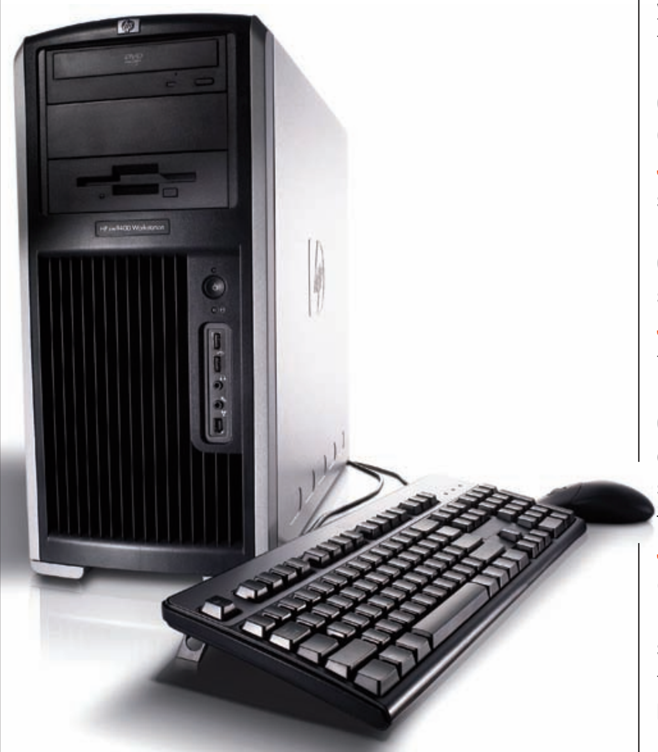
**GC:** In terms of power consumption do you provide any figures to help customers predict typical power consumption over a year?

**JW:** We do that, but primarily on a case by case basis. The challenge is power coming out of the plug is different wherever you go. The power here versus the power across the street can be different so that's a variable. Your system configuration is a variable. So we can give ball park numbers, but typically when customers ask that we go in and test their environment and give them a figure.

**GC:** But prior to that is there any way of a customer estimating how much a workstation will costs to run, over, say a three year period?

**JW:** We do a lot of Total Costing of Ownership analysis for the Blade workstations on behalf of our customers. In fact we've developed a tool into which they can plug in a few different variables and they can pop out an answer with the savings. We could potentially apply that to our personal workstations.

**GC:** In terms of technology, one of the value-adds that HP offers is its Performance Tuning Framework, which tunes individual workstation for specific applications. What's the latest news here?



**JW:** We're actually going to be embarking on a new branding strategy for that, as well as the Remote Graphics software, moving it more mainstream into volume CAD and Content Creation market, optimizing it specifically for some of the new AutoCAD software as well as 3ds Max, for example. We've got a lot of great tools that have been implemented and are being implemented. And as you move to a multi core environment it just opens up more doors for optimisation for us with that particular tool. So customers typically see a 10 up to 30% increase in performance over a standard distribution and again something that our competition can't do.

**GC:** So how are you achieving those levels of performance? The last time I saw the Performance Tuning Framework it was about making sure you had the right certified drivers to work with specific CAD applications. You also had some specific tuning for NX. Are you doing this for more and more applications as well now?

**JW:** UG (NX) is very specific because we developed the hyper tune infrastructure that goes right into the application and tunes, because UG has all the customer-tunable features,

3ds Max, you've got Max drivers, you've got Powerdraft drivers specifically for AutoCAD. We're interested in moving to other applications as well, but it's really going to be driven more where the market is going. So we're working with Autodesk for Revit. Inventor is probably going to be the next.

**CG:** So you said you're going to be doing some re-branding for the Remote Graphics Software as well?

**JW:** Potentially, yes, we're going to look at the volume segment. Remote Graphics Software doesn't always roll off the tongue. When you're talking to, maybe a consumer that's moving into a more prosumer area, you might need something a little more catchy to get them excited about it.

**GC:** Is there a lack of awareness for Remote Graphics? Do you think people know about it?

**JW:** The enterprise folks probably do. The rest of the small to medium business guys probably don't.

**GC:** Would you consider teaming up with a software vendor that's big in collaboration?

**JW:** Sure, but we have to be careful to figure out, if there is value to our end customer

**GC:** One final question. You currently have an eight core workstation with two sockets. Do you ever see HP releasing a four socket workstation in the future?

**JW:** We looked at that many years ago with single core designs. Actually Compaq developed one, but it never took off. We effectively have eight cores in a system now, so until Intel or AMD innovates and goes to eight cores per socket or whatever, we'll probably hang tight. -

***www.hp.co.uk/workstations***

# Workstation reviews

## CAD2 VISION DQX

**COLOSSAL AND POWERFUL** are probably the best adjectives to describe CAD2's new Vision DQX workstation. It's a specialist piece of kit, primarily designed for high-end design visualisation, though with a little tweaking on the graphics front the machine will be of equal interest to specialists in the area of structural analysis.

The system is built around two high-end Quad Core processors, Intel's Xeon X5460, codenamed 'Harpertown', which run at an incredibly quick 3.16GHz and feature a Front Side Bus (FSB) of 1,333MHz. Intel's Quad Core processors have really taken off in recent months and now match its Dual Core CPUs GHz for GHz. (In fact Intel's top end Quad Core Xeon, the X5482, actually outpaces the Core 2 Duo with a clock speed of 3.20GHz and a Front Side Bus (FSB) of 1,600MHz).

What this latest technology means for CAD2's Vision DQX is eight of the fastest CPU cores currently available, making it an absolute dream machine for users of multithreaded applications. On test the Vision DQX ripped through all of our standard rendering tasks with all eight cores working together extremely efficiently.

Of course, having all this processing power at your fingertips is of little use if you don't have the memory to back it up. The system comes with 8GB DDR-2 as standard, but will be able to take a breathtaking 32GB in its 8 slots when 4GB modules become available. Windows XP x64 Edition provides the headroom for all of this memory but be sure to check compatibility with your existing software. N.B. Autodesk currently ships 32-bit and 64-bit versions of 3ds Max on the same DVD.

All of this cutting edge processing technology is backed up with one of the most powerful professional graphics cards currently on the market. ATI's FireGL V8600 is an ultra high-end card featuring 1GB of on-board GDDR4 memory, and 320 Stream processors, which are dynamically allocated to geometry or shader tasks as required. This means you can harness the full power of the card regardless of whether your model is geometry heavy or texture heavy. In practice this translates to unprecedented levels of performance under high-end graphics applications like 3ds Max.



In terms of features the card also boasts 2 x Dual Link support, which means you can drive not only hi-res monitors like Apple's Cinema Display at resolutions of 2,560 x 1,600, but go right up to 9 megapixel displays featuring resolutions of 3,840 x 2,400. While many manufacturers stopped production of these breathtaking monitors last year, a revival is predicted in 2008. Stereo support, which can be used for immersive environments, also comes as standard in the FireGL V8600.

In summary, the Vision DQX is a beast of a machine, both in terms of size and performance. The raw computational power on tap for multithreaded applications is astounding and the ultra high-end graphics card provides plenty of power with which to manipulate enormous datasets fluidly. A mainstream CAD workstation it is certainly not but if you're in the market for a design viz or analysis powerhouse then £3,995 could still be money well spent for a machine which has the potential to revolutionize your production workflow.

***www.cad2.com***

### Specifications

**CAD2 VISION DQX**

- 2 x Intel Xeon X5460 Quad Core (3.16GHz)
- ATI FireGL V8600 (1GB)
- 8GB (4x2GB) DDR-2-667 ECC
- E-ATX Workstation Motherboard (Intel 5400X chipset)
- 150GB 10,000RPM + 500GB 7,200RPM Serial ATA
- Dual Layer DVD +/-RW
- £3,995

## Dell Precision M4300

**DELL WAS ONE** of the original vendors which fuelled the meteoric growth of mobile workstations and as a result has enjoyed unprecedented success with its Precision M series for many years now. The Precision M4300 sits in the middle of a new three model line up which includes the entry-level M2300 and high-end M6300. The system is based on its business-centric Latitude chassis which is solid in construction and features an excellent 15.4 inch screen which packs in the pixels at a resolution of 1,920 x 1,200 to enable high-definition CAD geometry. The maximum memory is 4GB and the top end CPU in the M4300 is Intel's Core 2 Duo T7700 (2.4GHz). Both were both present in our test machine. The professional 3D graphics is provided by the Quadro FX360M (256MB), Nvidia's entry-level mobile controller. This is fine for most 3D CAD applications, but will struggle under more graphics intensive applications like 3ds Max.



A standout feature of the M4300 is the option of a 32GB solid state drive instead of your normal hard drive. While capacity is smaller than the standard S-ATA drives offered with the system there are no mechanical parts in a solid state drive which improves battery life and durability, but performance can sometimes be slower. With Solid State technology improving all the time it may not be long before it takes over completely from mechanical hard drives in notebooks.

In addition to the standard WiFi and Bluetooth the M4300 also includes the option of Mobile Broadband through a tie in with Vodafone. Users simply insert a SIM card and can then browse the Internet or pick up emails wherever they can get a mobile phone signal. However, data transfer rates on these 3G networks can be erratic and slow.

Overall the M4300 is another excellent mobile workstation from Dell with solid build quality and cutting edge features. Previous low-end graphics implementations in Dell's Precision M series often fell short of customer expectations for 3D CAD. But despite the entry-level positioning of the Quadro FX360M, the controller is not too far off Nvidia's mid-range Quadro FX1600M in some CAD applications. My only qualm is that Dell doesn't offer the FX1600M as an option in the M4300 because if you want more 3D power, unfortunately you'll have to sacrifice portability and invest in a Precision M6300 which is a much bigger machine.

***www.dell.co.uk***

### Specifications

**Dell Precision M4300**

- Intel Core 2 Duo T7700 (2.4GHz)
- Nvidia Quadro FX 360M (256MB)
- 4GB DDR2 memory
- 160GB 7,200RPM S-ATA
- DVD +/-RW
- 15.4" TFT / 1,920 x 1,200
- £1,049


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